Determinants of Product Innovation in Organizations

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Determinants of Product Innovation in Organizations:

Practices and Performance in the Portuguese Financial Sector

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Determinants of Product Innovation in Organizations

Determinants of Product Innovation in Organizations:

Practices and Performance in the Portuguese Financial Sector

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1. Introduction

1.1. WHY STUDY PRODUCT INNOVATION IN AN ORGANIZATIONAL CONTEXT

This research is about the topic of product innovation. Its central premise is that to understand product innovation, one needs to understand the organizational context where it takes place. It is, therefore, a research about product innovation in organizations.

The importance of product innovation as a crucial means for organizational adaptation and renewal is a generally acknowledged issue. Business environments described as accelerated or hypercompetitive, increasingly demand the organizational capacity to dynamically manage a stream of new products able to make the organization less vulnerable to more innovative competitors.

As referred above, this work relies on the idea that product innovation must be considered in its organizational context. Such a contextual approach seems to be pertinent for, at least, two reasons:

(1) Product innovation occurs mostly inside organizations, thus being influenced by the organizational setting surrounding the process;

(2) Most research on organizational innovation in general and product innovation in particular, focuses exclusively on macro or micro variables, frequently ignoring the meso, organizational context in which new products are conceptualised and materialised.

Knowledge about how organizations can improve their product innovation performance, implies that attention be devoted not only to how process execution can be improved, but also to how the organizational context should be managed in order to support and stimulate the development and launch of more and improved products.

Considering the overall goal of the study, this work will blend contributions from marketing and organization science. It will try to show that both disciplinary fields can profit with such an approximation, and to join the limited but growing research projects that are presently promoting the cross-fertilisation between these distinct yet complementary domains.

1.2. RESEARCH GOALS

The conceptual view of product innovation presented above may be a fruitful one, since the usual approach to product innovation, centred and limited to the project level, is clearly insufficient for gaining knowledge of how it articulates with other, more general, aspects of competing and organizing.

Hence, the research goals of this work are related with the empirical testing of a model approaching the relationships between organizational contexts and product innovations. An operational model intending to study product innovation in the organizational context will thus be outlined and further tested. The model consists of three exogenous and three endogenous constructs, relating a series of contextual factors (organization, technology and orientations) with product innovation operations, outcomes and performance.

The main goal of this research, therefore, consists in analysing how these constructs are linked as well as improving our knowledge about their impact on product innovation performance. Such an approach provides the opportunity for simultaneously addressing two types of research goals:

(1) Scholarly goals. Current research on the product innovation process frequently adopts a highly prescriptive and a-theoretical stance. Chapter 2 provides a relatively detailed review of this literature. In this work, product innovation operations are contextualized within the broader organizational setting where they occur. By taking this perspective, it intends to add theoretical richness to the product innovation issue. The model under analysis is also expected to highlight what antecedent factors influence the quality of product innovation operations, and the actual impact of these operations on the product innovative performance of the firm. By putting under the same theoretical framework the firm's articulation with its business environment and its capacity for converting externally-based information into new product innovations, the research will thus test the relationship between a market orientation and product innovation practices and performance, as well as the adequacy of the organizations as sponges metaphor (Fiol, 1996), an image of organization that simultaneously addresses several of the concepts integrated here.

(2) Managerial goals. Surveys about product innovation practices in organizations, systematically show that there is a gap between the prescriptions advanced by the literature and actual development operations. This work will test what organizational factors have a positive influence on the rigorous execution of product innovation operations. In applicable terms, this may uncover some of the reasons why organizations so often resist the adoption of prescribed development operations, and suggest what factors can and should be managed in order to increase organizational porosity to the normative guidelines suggested by product innovation researchers. Moreover, this work also intends to test to what extent it is possible to flesh the 'market orientation' concept by operationalizing it in a set

of practices that explain how market-based information can give birth to new products that provide superior value to the customer.

1.3. ORGANIZATION OF THE BOOK

In Chapter 2, a review of the product innovation literature is presented. It tries to present a complete perspective of the research on the subject. In order to do so, the chapter starts with a presentation of the product innovation concept. Then, it proceeds with the introduction and discussion of a theoretical framework for analysing the literature. Such a framework is structured in three different levels of analysis: environmental, organizational and project levels. The discussion then focuses on the importance of development operations to product innovation performance. The chapter ends with a brief discussion of possible research directions intended to improve theoretical and applied understanding of product innovation in organizations. This chapter, aims to integrate and provide a general overview of the accumulated research. Considering the diversity of approaches to the topic, such an attempt seems to be pertinent and important to understanding the relevance for an organizational approach to product innovation.

Chapter 3 builds and extends the theory presented in Chapter 2 to sketch a testable model of product innovation from an organizational perspective. The proposed model provides a comprehensive approach to product innovation, and integrates a set of stable and dynamic organizational determinants of a firm's product innovation performance.

The methods are presented in Chapter 4. Here, it is described how the study unfolded, provided a general picture of the research universe, explained how the sample was constituted, described the construction of the survey and discussed the analysis that led to the determination of the final research instrument.

Chapter 5 presents and discusses the empirical results. The chapter starts with an analysis of descriptive statistics, which provides a perspective of actual product innovation practices of the participating companies. Subsequently it tests the structural model of product innovation performance, and finally applies a set of regression analyses in order to make some relationships within the structural model more explicit.

The conclusions arising from the research are presented and discussed in Chapter 6. This chapter contrasts the research results obtained in this study with those of other researchers, discusses the study's limitations, proposes avenues for future research, and derives some evidence of best practice in the management of product innovation.

1.4. IMPLICATIONS

There are some interesting theoretical and applicable implications of this study to the product innovation discipline. On one hand, it confirms some well-established findings in the field, namely the impact of a detailed and rigorously implemented development process for the firm's product innovation performance, and the importance of technological prowess. Additionally, it confirms the potential usefulness of integrating product innovation with the study of information acquisition and utilization. The recognition of the crucial role played by information also links the subject of product innovation with related fields, including market-driven management, and confirms the fruitfulness of the recently introduced metaphor of organizations as sponges.

This work supports the assumption that product innovation is a situated and context-dependent activity, whose management requires not only rigour and proficiency at the level of the development process, but also the articulation of a set of organizational processes and competencies. A deep understanding of product innovation performance, thus, demands a cross-fertilisation between the marketing and organizational disciplines. This work hopefully provides an example of the academic and managerial advantages arising from the integration of these different yet related fields.

2. Product Innovation: A Literature Review

Product innovation is a potential source of competitive advantage for most contemporary organizations[1]. The growing visibility of product innovation management as a scientific and applied field is probably related to the emerging characteristics of competitive environments: high-speed (Eisenhardt, 1989), hypercompetitive (D'Aveni, 1995) business environments are forcing companies to develop more and better products, and to do it faster than competitors. It is then possible to speculate that recent progress in new product research is more determined by an industry-push than by some kind of academic-pull. This perspective helps to comprehend why some claims are being made for a better combination of academic and industrial perspectives (e.g. Ellis, 1995). The model developed herein will follow this suggestion, in that it will try to test the influence of organizational contexts over product innovation practices and outcomes.

Considering that product innovation is a necessary (although not a sufficient) condition for organizational success, it is without surprise that one can observe that the field is becoming more and more vast and vibrant. The literature review recently published by Brown and Eisenhardt (1995a) pointed out, however, that despite the vividness characterising the field, there is a long journey for research to follow. As the authors wrote: 'because this large and fragmented literature has not been tied together to create cogent understanding, it is difficult to grasp what is actually known' (Brown & Eisenhardt, 1995a: 344).

The purpose of this chapter is to provide an overview of the literature that focus product innovation. The resulting picture may be of some help to overcome the fragmented state of the knowledge on product development. It will serve as a guide across the literature on product innovation, in order to pave the way for the presentation, in chapter 3, of an organizational model of product innovation performance. Before entering the presentation of the literature overview, the concept of product innovation is discussed in order to make clear what it means throughout this work.

2.1. THE CONCEPT OF PRODUCT INNOVATION

Authors reviewing the literature on organizational innovation do often refer that the only consistent finding on the topic, is the inconsistency of the results (e.g.

[1] This work's focus is on organizations competing for survival. The terms 'firm' and 'organization' will then be used interchangeably.

Downs & Mohr, 1976; Wolfe, 1994). One of the reasons probably accounting for this inconsistency is the indeterminate nature of the concept of innovation: the concept of innovation has many meanings, ranging from the individual to the ecological levels of analysis (Fonseca, Cunha & Gonçalves, 1996).

A preferable way of overcoming this labelling confusion is to be more explicit and focused when writing about innovation. The vagueness of the prefix 'organizational' may be substituted by more explicit and focused labels like product, process, administrative, technological, radical, incremental, ancillary, architectural. This proposal tries to encompass the need for analytical clarity, distinguishing between the concept's dimensions, like magnitude, type, or content.

This work is about product innovation. By product innovation it is meant the process of development of a new product by an organization[2]. A new product can be defined as a product that meets customer needs not currently met by the organization. Its development includes the stages considered by Dougherty (1996): conceptualisation, development, operationalization, manufacturing, launch and ongoing management. New products can greatly vary in terms of their innovativeness, ranging from minor modifications of existing products to completely new product categories. In this work, to be considered a product innovation, the product must be new to the organization. It is important to note that the terms product innovation and new product development will be used interchangeably. The multidisciplinary nature of new product innovation research concurred to create a diversity of labels to the phenomenon, which include the two referred above (product innovation and new product development) as well as some additional ones, like innovation, design, or new product design. As pointed out by Hart (1995) the proliferation of labels in use may be a direct consequence of the multiplicity of disciplines studying product innovation. These disciplines range from economics to engineering, manufacturing, marketing, operations research, and organizational behaviour, among others.

The interest concerning the study of product innovation relates primarily to the fact that it is a fundamental means for organizational renewal (Dougherty, 1992). By launching new products, companies are able to maintain or improve market share and accompany the pace of environmental change. Despite the importance of product innovation, however, empirical findings are showing that companies have difficulty in developing and launching viable new products (Cooper, 1993).

The persistent shortcomings in the new product development process, suggest that more research is needed to achieve applied relevant conclusions about the way firms should manage product innovation. This chapter will try to present and

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[2]A product can be defined as 'anything that can be offered to a market for attention, acquisition, use, or consumption, that might satisfy a want or need' (Kotler et al., 1996, p.931).

to briefly discuss the research results accumulated up to now. This literature overview, in turn, should clarify the advances and the gaps characterising knowledge on the subject. This effort of literature integration is not original, but it is expected to complement early reviews, namely those conducted by Brown and Eisenhardt (1995a) and Hart (1995). The reason underlying the potential complementarity between this and the above reviews, lies in the guidelines structuring the review's framework: Brown and Eisenhardt organize their literature review around the rational plan, communication web, and disciplined problem solving research streams, while Hart reviews the research examining product innovation from the critical success factors perspective.

This review, in turn, will give to the organizational context the pivotal role of explaining and understanding the development of new products. Such a perspective will be adopted given the fact that much research on innovation tends to focus on the project or industry levels (Adler, 1989). A gap exists at the organizational level of analysis, which makes it difficult to articulate markets with innovations. The major goals of this chapter are twofold: (1) to analyse if firms' adaptation strategies (including strategic type, technology strategy, and market orientation) impact the way product innovation is managed; (2) to analyse the ways in which different orientations toward product innovation influence organizing processes.

This chapter will view product innovation as a context-dependent activity, that looses meaning if analysed outside of the organizational environment where it takes

2.2. PRODUCT INNOVATION: A FRAMEWORK FOR ANALYSIS

The overview of the literature discussed in this chapter, takes as its starting point the framework presented by Rosenbloom (1978, in Adler, 1989) and subsequently utilised by Adler (1989) for a purpose similar to the one orienting this chapter, although focusing on a different subject of interest (technology strategy). Rosenbloom's framework highlights the interaction between three levels of analysis: the environment, the organization, and the innovation. This perspective will be used as an organizing framework for the literature review to be conducted in this chapter. Two reasons account for the adequacy of Rosenbloom's framework to this work: (1) it considers the unique contribution of each level of analysis to the development of new product innovations; and (2) it allows the integration of contributions from different levels of analysis.

An additional argument for the usefulness of Rosenbloom's framework, refers to the pivotal role played by the organizational level: organizations are the entities that link environmental needs and project specificity's. In other words, they can be thought of as the crucial elements for the success of demand articulation (Kodama, 1995), i.e. to the translation of more or less vague wants into well-defined new products. In the same vein, Tushman and Rosenkopf (1992) stressed

the usefulness of organization theory to uncover the roots of technological change and innovation. The centrality of the organizational level to our model does also have an additional benefit: considering that, as pointed out by Brown and Eisenhardt (1995a), innovation research splits into the economic and organizational areas, and that this work focuses this later area, then the framework is consistent with the focus, which is a necessary precondition for conducting a literature review.

Attempting to provide a brief guide to the literatures on the topic of product innovation, this chapter will be organized around three main sections: section 2.2.1 will explore the importance of the external environment; section 2.2.2 will refer to the organizational context; section 2.2.3 will focus on the product innovation process. Figure 2.1. graphically displays the structure of the chapter.

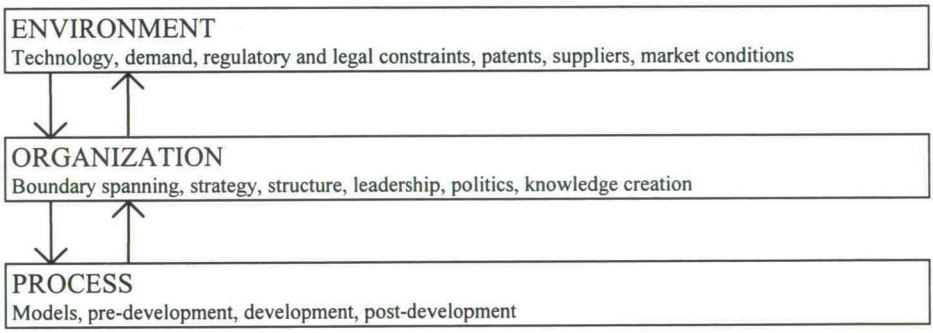

Figure 2.1.
An organizational analysis of the product innovation process

Since product innovation is an externally-oriented activity, intended to satisfy customer needs and thereby contributing to help the organization in adapting to its environment, theoretical discussion will start with the external environment.

It is worth noting, before proceeding to the presentation of the three levels of analysis, that the analytical separation by levels is an artificial way of isolating practically related issues. Several authors have pointed out the dangers inherent to extending this separation to the process itself. As remarked by Dougherty (1992), technology, market and organization are interrelated components of the product innovation process. Consequently, they can not be understood separately; they must, on the contrary, be approached from an integrative and comprehensive perspective.

2.2.1. The external environment

Factors that are external to the organization can exert powerful influences on the way it develops new products. In this section, the impacts of the following factors will be analysed: technology, demand, regulatory and legal constraints, patents, suppliers, and market conditions.

2.2.1.1. Technology

Changes in technology have direct influence on the way companies manage product innovation. The most obvious influence is the shortening of product life cycles, a phenomenon that is well documented in the marketing literature (e.g. Qualls, Olshavsky & Michaels, 1981). However, other consequences are visible and deep. Product customisation was made possible by computer integrated manufacturing, a 'combination of high variety production technology, automated management of knowledge work, and integrated communications between and among business functions, vendors and customers' (Goldhar & Lei, 1995: 75).

New technologies have two orders of impacts on new product development: they make the creation of new products possible, and they materialise new ways for developing these products.

Because they make new products possible, new technologies are, on the one hand, a cause for the removal of products based on conventional technologies. As pointed out by Von Braun (1990), the traditionally long period of time needed for a technology to be substituted by the next, is now occurring within shorter periods of time. This high acceleration rate is posing new threats as well as opportunities for technology strategists. As stated by Von Braun (1990), technological acceleration puts product innovation at the heart of managerial thought and action: 'The younger its product spectrum, the more up to date and state-of-the-art its products, and the more nimble the company itself' (p.49). On the other hand, new technologies (such as computer aided design, computer aided manufacturing, computer aided engineering, computer integrated manufacturing, flexible manufacturing systems), have created new ways of organizing for product development (Hayes & Jaikumar, 1988). These technologies allowed for more flexibility, speed of development, and delivery, thus introducing significant changes in organizational operations, including new product development.

Investing in technology may result in technologically-superior products, which, in turn, may put a company in a situation of quasi-monopoly which can offer significant profits until competitors may be able to launch similar or more sophisticated product features. This continuous search for technological/product superiority, creates competitive pressure at the level of entire industries, and therefore the need for more advanced technology.

2.2.1.2. Demand

In theoretical terms, customer needs are expected to trigger the development and launch of new products. Empirical evidence that supports this prediction has been presented, for example, by Cooper (1979) and Cooper and Kleinschmidt (1987). According to the authors, product advantage was the most important predictor of product success. Product advantage refers to the extent a product is adequate to solve customer needs better than competitors' products, and it can be assessed according to such criteria as unique benefits to customers, high quality, degree of innovativeness, and price attractiveness. These results suggest that market-pull can be more determinant to product success than technology-push.

The impact of these conclusions may however fade away if one remarks that successful products do always appear as able to satisfy customers' needs if analysed on a retrospective basis (Adler, 1989). According to this line of reasoning, more pertinent than discussing the importance of the technology-push vs. market-pull perspectives, is to analyse how technology developers and technology users interact to give birth to new products (Von Hippel, 1986), and how does the demand structure evolve over time (Urban & Hauser, 1993). This perspective is congruent with the research of Brockhoff and Chakrabarti (1988) which shows that technology-push and market-pull products are equally likely to be commercially successful products. In consequence, some authors (e.g. Johne & Snelson, 1989) are noticing the need for a perspective that makes a fusion between technology-push and market-pull perspectives. In addition, empirical evidence obtained by Lawton and Parasuraman (1980) showed that, contrary to previously held assumptions, the extent of adoption of the marketing concept by a company, did not affect new product innovativeness, or in other words, that market-pulled products are not necessarily less innovative. A possible way out of this controversy is to view innovation as an interactive process between market and technological orientations (see Burgelman & Sayles, 1986).

The literature on the supply vs. demand controversy, often uses the example of Sony's Walkman to show how listening to customers may not be the best source of innovation[3]. Nevertheless, this example does not indicate that customers are unimportant when it comes to innovation. As pointed out by Flores (1993), it only stimulates companies to listen customers carefully, instead of exclusively relying on information-gathering. More than collecting information, companies are expected to go beyond the explicit wants and needs of customers, and to create and explore future possibilities, which customers are not able to articulate by themselves. This can be accomplished either by marketing and engineering groups, as reflected for example in the concept of market orientation (Kohli & Jaworski, 1990; Narver & Slater, 1990). This concept does not limit activities

[3] Sony's walkman is often presented as an example of how the persistence of a product champion may lead to the development of product innovations whose market potential can not be devised in advance (Morita, 1991).

usually thought to be part of marketing's responsibilities to the marketing department, transferring the responsibility for their execution to the organization as a whole.

2.2.1.3. Regulatory and legal constraints

Regulatory and legal constraints to product innovation can be considered one of the less malleable requirements facing new product development (Bloch, 1995). Many examples could be provided to illustrate these kinds of constraints: the guidelines to packaged foodmakers, the safety norms for toy manufacturers, and the regulations concerning environmental protection and the disposal of goods.

The need to develop environmentally-responsible products, for example, has been mainly triggered by environmental legislation developed in the context of the Single European Act (Dermody & Hanmer-Lloyd, 1985). Environmentally responsible products, are those that 'have no undue environmental impacts and are safe in their intended use, that are efficient in their consumption of energy and natural resources, and can be recycled, reused or disposed of safely' (Shrivastava, 1995: 948). Legal and societal pressures are stimulating organizations to integrate environmental issues into the new product development process. The call for introducing environmental concerns in the product development process has been made in the marketing literature by Varble as early as in 1972. The increasing awareness of the environmental effects of global competition (see Grupo de Lisboa, 1994) seems to be the main reason for the recent growth in interest towards the development of environmentally responsible new products.

It should be noted that normative constraints can also be originated inside the organization, in order, for example, to guarantee that high levels of product reliability are achieved.

2.2.1.4. Patents

Patents are frequently viewed as means for protecting competitive advantage. When patents are unobtainable, some companies try to substitute them by trade secrets. Although recognising the importance of patents in some industries, namely in the chemical industry, it is important to note that apparently more effective than relying on patents is the adoption of an offensive attitude intended to develop capacities instead of the opposite attitude of creating barriers (Adler et al., 1989).

There are at least two reasons which suggest that firms should not rely excessively on patents: (1) patents are difficult to obtain and are often invalid in court; and (2) patents are not an insurmountable obstacle, because they rarely allow complete long term protection.

Even when they provide complete protection, there is another reason for avoiding excessive reliance on patents: because of the long lead time intervals between the discovery of a patentable technology and its commercialisation, it is possible that the protection provided by the patent expires when the product is still in an early phase of its life cycle.

All these reasons help to understand why some companies are trying to excel in the development of sophisticated process technologies, that are more powerful competitive obstacles than patents. As reported by Pisano and Wheelwright (1995), some pharmaceutical companies are now using proprietary process technology as a way of defending themselves after a drug's patent expires.

2.2.1.5. Suppliers

The interest generated by the study of Japanese management, highlighted the importance of suppliers for fast new product development. Strong ties with suppliers have proven to be important given that suppliers can develop technical expertise in specific areas, which, in turn, makes them able to quickly fulfil a firm's requests. The importance of suppliers has been illustrated by Kamath and Liker (1994), who have remarked the benefits arising from close relationships with preferential suppliers, benefits expressed namely in terms of speed of development and reduced manufacturing costs.

Firms are increasingly relying on the collaboration with external suppliers during their new product development processes, because suppliers provide a higher percentage of product value added. If this may diminish the necessity for huge internal capabilities of R&D, it will not diminish the need for a deep understanding of technological possibilities and limitations. This knowledge is fundamental for making decisions concerning the strategic management of technology and innovation. One of the potential causes of unsuccessful product development is the excessive reliance on internal development, which leads firms to ignore the benefits of strategic alliances (Wind & Mahajan, 1988).

Much literature on the importance of supplier networks for product innovation comes from Japanese case studies. This excessive dependence on Japanese firms makes it less clear to know to what extent the relation between firms and suppliers can be adopted by non-Japanese firms in their national contexts of action. Considering that some discussions about the involvement of suppliers occur only at a very superficial level, there is also the risk of misinterpreting the way Japanese firms cooperate with suppliers (Kamath & Liker, 1994). The analysis conducted by Lillrank (1995), may be useful for understanding some of the problems arising from transferring management innovations from Japan to the West.

2.2.1.6. Market conditions

The role of market conditions is nowadays considered to be an important determinant of an industry's competitiveness (Porter, 1980). The importance of market characteristics to product innovation success has been empirically demonstrated by Cooper and Kleinschmidt (1987). In their study using 203 products – of which 123 were successes and 80 were failures – from 125 manufacturing firms, they concluded that products launched in large and growing markets were more likely to be successful.

On the one hand, these findings suggest that markets influence product success. On the other hand, the same empirical research (Cooper & Kleinschmidt, 1987) also showed that market characteristics were less important than product and organizational factors. A subsequent study by the same authors (Cooper & Kleinschmidt, 1993), replicated the previous research for European and North American chemical firms. The results showed, in this case, that there was no relationship between market competitiveness and product success. Research conducted by the Stanford Innovation Project indicated that market conditions can impact product success, and namely that early entry into growing markets could work as a facilitator of success (Zirger & Maidique, 1990). Again, established markets may dismay companies to conduct product innovation: as noted by Grden-Ellson (1986), financial companies have for a long time adopted highly reactive new product practices, in most cases copying or re-pricing competitor's products. Future analyses of the phenomenon from an ecological level of analysis may shed some light on the subject.

One market variable that deserves further exploration is an industry's protection from product imitation. If barriers to imitation did not exist in such forms as patent protection, high investments or production capacity (MacMillan, McCaffery & Van Wijk, 1985), companies would need to gain enough profits to justify the launch of a product in the first place. In relation to this variable it will then be important to study such topics as the estimation of response lags (the time interval mediating between a new product introduction and competitors' imitation of that product) in different industries, the influence of response lags in a firm's competitive behaviour and the risks and advantages of pioneering innovation, of repeating pioneering innovation, and of imitative behaviour.

2.2.2. The organizational context

Some recent literature reviews on organizational behaviour are showing that the organizational context is a powerful influence on the behaviour of individuals and groups (O'Reilly, 1991; Mowday & Sutton, 1993). Hence, if one intends to understand the behaviour of people and teams engaged in the new product development game, one needs to understand the organizational context in which these players act.

There is a wide body of literature suggesting the importance of organizing for product innovation. This literature is highlighting the fact that it is not enough to monitor the environment in search of new opportunities for innovation, and suggesting new ways of organizing for stimulating the creation of new products, including: new venture units (Bart, 1988), cross-functional teams (Hitt et al., 1996), multiple horizon organization (Brown & Eisenhardt, 1995b), or improvisational approaches (Bastien & Hostager, 1988).

In this section, the management of product innovation will be analysed according to a three-fold process perspective, including: (1) the acquisition of inputs; (2) the transformation of inputs; and (3) the launch of outputs. This systemic perspective is a potentially enriching way of approaching the subject in a simple but integrative view. This discussion will start with the acquisition of inputs.

2.2.2.1. Acquiring inputs

By acquisition of inputs it is meant: the set of processes and actions aimed to importing, from the external environment, all the resources needed for developing new products. Given their centrality the focus will be exclusively on the environmental scanning and boundary spanning processes.

2.2.2.1.1. Environmental scanning and boundary spanning

Competitors' responses to new product introductions can be approached from at least three perspectives (MacMillan, McCafferty & Van Wijk, 1985): a rational policy perspective, an organization process perspective, and an organizational politics perspective.

According to the rational perspective, competitors' responses are the result of a series of steps: the company scans the environment, obtains information about external threats and opportunities, conducts an internal diagnosis to identify corporate strengths and weaknesses, and defines a strategy that articulates organizational strengths with market opportunities. Three characteristics of new products can be expected to stimulate rapid and vigorous response (MacMillan et al., 1985): high product visibility, high perceived potential, and the probability of damaging the competitors' market position.

As the above example clearly shows, environmental scanning, i.e. 'seeking to see some synthesis or synergy between ideas and fields of knowledge that competitors have missed' (Burgelman & Sayles, 1986: 36), is a crucial step for the definition of a company's strategy. A central role in this process is that played by gatekeepers. Gatekeepers can be described as high-performing individuals that communicate more often with people outside their area of speciality. Their role is valuable to product development teams in that they import information from outside sources and disperse that information throughout the group. Relevant external information may come at least from three different sources: competitors

(Ghoshal & Westney, 1991), customers (Von Hippel, 1986) and sources outside the industry, namely universities and related industries (Porter, 1980).

The relevance of boundary spanning has been abundantly noticed in the innovation literature. Katz and Tushman (1981), studying 60 project groups in a large corporation, found that teams with gatekeepers performed better than teams without them. These findings may be theoretically linked to Von Hippel's suggestion of the importance of lead users: communicating with key external actors may be a fundamental activity for conducting successful product innovation. Subsequent work by Ancona and Caldwell (1992) analysed the boundary spanning strategies utilised by 45 product development teams. Their data showed that the frequency of external communication was not a significant predictor of team performance. The study allowed to conclude that more important than communicating in quantity, is communicating with quality, i.e. of making an adequate use of the several communication strategies allowed by boundary spanning activities, namely political manoeuvring and impression management. Frequent communication with outsiders to the organization may have other advantages as well: as concluded by Katz and Tushman (1981), frequent communication with outsiders opened up team members to new information, which in turn may potentially increase a firm's absorptive capacity (Cohen & Levinthal, 1990), the capacity to assimilate and integrate new information on decisions concerning new product development. This concept, in turn, is congruent with the idea that information richness can lead to better solutions to problems (Daft & Lengel, 1986). Considering that product development is becoming more and more an activity of interpreting and translating customers' wants into new products, concepts such as absorptive capacity and information richness become central to the product innovation literature.

2.2.2.2. Processing inputs

After having acquired the resources needed for developing new products, companies need to process these resources in order to transform them into new products. The processing activity is influenced by a series of factors, namely the strategy, structure, processes, leadership style, power and politics, and organizational knowledge creation and utilization.

2.2.2.2.1. Strategy

Some strategy and marketing literatures cast companies as players of games of action and reaction (MacMillan, McCaffery & Van Wijck, 1985; Miller & Chen, 1994; Dickson, 1997). This perspective, that is also well illustrated in the field of new product development (Maruca & Halliday, 1993), portrays organizational action, namely product innovation, as an evolving, longitudinal, open-ended and unpredictable process.

Considering the centrality and long term impact of new product development goals, and the need to manage product portfolios, it seems important to integrate product goals with the organizational strategy or, in other words, to define a clear set of goals to be fulfilled by new product development projects. This need has been identified, among others, by Cooper (1987) and Larson and Gobeli (1989).

In this section, two alternative approaches to organizational strategy-making will be analysed and contrasted, so that their implications for new product development may be more easily devisable: (1) a normative approach; and (2) a process approach. These approaches are presented as illustrations of a prescriptive and a descriptive mode, and represent two distinct positions about organizing and managing organizations in general, and new product innovation in particular.

2.2.2.2.1.1. A normative approach

The normative model of strategy formulation has been, for a long time, the dominant perspective in strategy studies (Hutt, Reingen & Ronchetto, 1988). This model emphasises the rational nature of strategy formulation and assumes the inherent rationality of organizations as well as the existence of organizational unity of purpose.

This line of research typically assumes that an organization tends to choose one from a diversity of possible strategic scenarios, and to formulate and implement a strategy in order to beat competitors in the marketplace. These strategic scenarios influence the way an organization will chose to develop and launch new products, namely by limiting the windows of opportunity to the which the organization will preferentially look for. As pointed out by Cooper (1985), the corporate strategy may be expected to influence the overall new product strategy, being new product strategy expected, in turn, to influence new product performance and company results.

In order to test these relationships, Cooper (1985) collected data on the corporate strategy/product strategy relationship, from a sample of 122 industrial product manufacturing firms. The author identified five major strategic types:

(1) the technologically-driven strategy, characterised by technological sophistication, state-of-the-art development technologies, R&D orientation, and pro-action in generating new product ideas. These firms were also characterised by deficient marketing orientation, failure to focus on lucrative markets, and the lowest rates of new product success of all five types of strategies.

(2) balanced focused strategy, included the best performers of all strategic types. These companies were defined by the same kind of technological concerns characterising technologically-driven companies, but they also demonstrated a high degree of market orientation.

(3) technologically deficient strategy, a strategic type that tends to generate a comparatively low proportion of sales resulting from new products, and whose product programmes tend to be perceived as the less satisfactory of all five strategic types in meeting corporate goals. The companies adopting this strategy were characterised by a reactive approach to the marketplace, passive idea search, entry in unfamiliar markets, and a lack of technological sophistication. These firms' strengths in marketing, and especially in their sales forces, were not enough to overcome the weaknesses of the corporate 'non-strategy' (Cooper, 1985: 188).

(4) high budget, diverse strategy, composed of firms that had the lowest investments in R&D of all types, and that essentially launch 'me-too' products. The moderate results that this strategy allows companies to achieve, result from their synergy with the existing product base of the firm and from high levels of operational efficiency.

(5) high budget, diverse strategy firms, featured the highest percentage of investment in R&D, which doesn't lead, however, to an aggressive technological strategy like that presented by the technologically-driven strategy. A lack of focus and orientation helps to understand why these big spenders disperse significant R&D resources throughout several areas that should be approached in diverse ways. This dispersion seems to result in perceived weaknesses in terms of production, sales, and distribution.

Although implicitly, this research suggests that corporate strategy, pointing the directions to follow and the routes to explore, clearly affects the organization's new product strategy and consequently its product innovation performance. The study also points the need to develop more research on the link between corporate and product strategies, so that the interactions between them may be uncovered. This seems to be a relevant research line to follow, considering that the usual focus on individual projects makes it hard to analyse in which ways the development of particular projects affects and is affected by a firm's strategy.

2.2.2.2.1.2. A process approach

Contrary to the normative approach, the process approach to strategy-making conceptualises organizations as collections of people with different perspectives, goals, and purposes. This means that strategy-making is viewed as an emergent rather than intentional, messy rather than aligned, and political rather than rational process.

The process approach to organizational strategy is a subfield of growing importance, thanks to the works of eminent scholars like Mintzberg (1978) and Quinn (1978), and to the managerial impact of discoveries made by the science of

complexity, which may be assessed for example in the workings of Stacey (1995a).

The antecedents of the process school of decision making can be found on concepts such as 'satisficing' (March & Simon, 1958), 'garbage cans' (Cohen, March & Olsen, 1972) and 'muddling through' (Lindblom, 1959). These concepts are highly enriching for understanding organizations, because they highlight the importance of incremental, boundedly rational, and disjointed decisions, for organizational functioning and analysis.

An empirical investigation by Burgelman (1983a) illustrates the importance of emergent processes on strategy-making. The monitoring of six ongoing venture projects during 15 months showed the emergent nature of the company's strategy. Three elements are particularly important in this emergent process: (1) the existence of product-championing activities at the operational level; (2) the capacity of middle-level managers to evaluate the strategic implications of the initiatives led by product champions; and (3) the willingness of top management to change the corporate strategy's direction as a direct consequence of intrapreneurial activities. As the study illustrates, corporate strategy may be described as a function of the efforts developed at the operational level and, in that sense, as an emergent process.

As this and additional research by the same author (Burgelman, 1983a, 1991) illustrates, product innovation, being a major source of organizational renewal, can shape and change an organization's strategy by suggesting new directions to follow and new opportunities to explore. As Burgelman (1991) reports, the change of Intel from a memory chip to a microprocessor company has mainly been due to product development. If product innovation is an essential driving force for organizational adaptation, it is not surprising to see that it is powerful enough to influence an organization's strategy. This impact, however, has been relatively under-researched, if compared with the amount of investigation on the congruence between a company's product portfolio and its strategic orientation, mainly conducted under the rationalist, normative paradigm.

Hutt, Reigen and Ronchetto (1988) also demonstrated how a new product emerged informally, to later become formally adopted by the organization. The study also pointed out the importance of product champions in developing new products coming from the bottom of the hierarchy. As shown by the authors, product champions may be instrumental for detecting the opportunity, defining the need, and realigning the distribution of organizational resources in order to take advantage of the detected opportunity.

The study of Hutt et al. (1988) has also noted that top-down and bottom-up approaches may be conceptualised as complementary perspectives of the same phenomenon: once the product champion demonstrated the project's potential, the project may be adopted by organizational champions (like marketing or R&D

managers) who will try to integrate, to position and to formalise it under the company's strategy. If the efforts of the product and organizational champions are successful, the process then becomes top-down oriented, clear attributions and responsibilities will be assigned, and a formal procedure will substitute the once informal, messy, and bottom-up approach. The need to balance the top-down and bottom-up perspectives on strategy making, has been noticed previously in the marketing literature (Day, 1981), which suggests it to be a potentially fruitful route to follow.

2.2.2.2.2. Structure

As a topic of interest for the understanding of product innovation, organizational structure has been fundamentally approached from two perspectives: (1) a general perspective that focused the search of the best structure for innovation; and (2) a set of more specific and particularistic approaches, that focus more attentively on segmented, structure-related topics.

2.2.2.2.2.1. The 'best structure' approach

The search of a best structure for innovation is a long-standing topic of interest in organization science. The answer to the 'best structure' question is relatively easy to find when firms only produce a single product at a time. In this case, companies working with a product in its early phase of development could be expected to adopt designs that facilitate innovation and flexibility: organic structures. As the new product design is taken into production, more mechanistic structures emerge as the most appropriate design (Burns & Stalker, 1961; Lawrence & Lorsch, 1967).

The problem with the above logic is that most firms manage product portfolios with products in different stages of development. This is far from surprising, because a well-managed, diversified product portfolio seems to be a powerful competitive tool (Kotler, 1988). The question then becomes: what is the best structure for a firm that simultaneously manages a portfolio with different products in different phases of the product life cycle?

Donaldson (1985) provides an answer to the above question. Based on the findings of contingency theory, the author built a theoretical model which tried to discover what is the best organizational design for multiproduct companies. According to contingency theory, three different structural forms are available for the multiproduct organization: product divisions, project teams within a functional structure, or a product functional matrix. The appropriateness of these forms to the particular situation of an organization depends on two dimensions: the life cycle stages of the company's products, and the degree of product relatedness. The importance of these two dimensions is justified as follows: the product life cycle stage directly influences the level of product and process innovation of an organization; product relatedness matters because organizing by

function tends to prevail when there is a high level of product relatedness, while organizing by product tends to occur when there are several unrelated lines of business.

According to empirical findings obtained from contingency theory research, the adequacy of some structural arrangements may be easily devised: structuring by function is most adequate to situations of product relatedness and lack of innovativeness, while structuring by product is most appropriate under conditions of product unrelatedeness and innovativeness. Problems arise when, for example, an organization possesses a set of related products but wants to achieve a high degree of innovativeness: in this case, the best structural solution is not obvious. To provide an answer to the best structure question, Donaldson (1985) built a model in which the joint implications of product diversity and product life cycle stage were considered simultaneously. The product life cycle stage was positioned in a continuum ranging from early (referring to the innovation stage) to mature (referring to the production stage), including the following classes: all early, mostly early, mostly mature, and all mature. The dimension product diversity, first considers whether there is one or more products. For multiproduct organizations, two situations were devised: related and unrelated products. For both the single and multiple product corporations, two situations are considered: situations with slow and situations with rapid product mix changes. The combination of the product diversity and product life cycle dimensions originates the set of prescriptions presented in tables 2.1, for the case of the single-product company, and 2.2 for the multiproduct company.

Table 2.1
Product life cycle and organizational structure:
The case of the single product company

Slow product changes	**Structural type**
All early	Fo
Mainly early	(non assigned)
Mainly mature	(non assigned)
All mature	Fm
Rapid product changes	
Early	Fo
Mature	Fo

(Adapted from Donaldson, 1985: 31)

Table 2.1, as well as table 2.2, should be interpreted according to the following key: **F** is for functional, **PD** to product division, **M** for matrix, **P** for project, **Fp** to functional with projects, **o** for organic, and **m** for mechanistic.

Table 2.2
Product life cycle, product relatedness, and organizational structure: The case of the multiproduct company

Slow product mix changes	**Related**	**Unrelated**
All early	PDo	PDo
Mainly early	PDo-m	PDo-m
Mainly mature	Fpm-o	PDm-o
All mature	Fm	PDm
Rapid product mix changes		
Early	Mo	Po
Mature	Mo	Po

(adapted from Donaldson, 1985: 31)

As illustrated by Donaldson's model, there is not a 'best way' to organize for product innovation: the best structure depends (is contingent) on the number and the diversity of products that a company is developing and/or manufacturing. The reasons why a particular structural form is best suited for a particular situation will not be discussed: they would require a relatively deep discussion of contingency theory which is beyond the scope of this work. The theoretical arguments underlying tables 2.1 and 2.2 can be analysed in Donaldson (1985). The important thing to note here, is that sixteen organizing ways have emerged in response to the best structure question. This is in sharp contrast with some 'false truisms' that proliferate in the innovation literature, that tend to present single and universal solutions to such a complex problem.

2.2.2.2.2.2. Particularistic structural perspectives

Many particularistic approaches to the relationships between structure and innovation can be found in the literature. Particularistic approaches are those that focus on specific structural effects, instead of analysing the macro organizational structure as a single, all inclusive variable. These approaches have mainly been stimulated by the recognition that the relationship between structure and innovation is a very complex one, asking to equivalently complex and sophisticated theoretical explanations. As pointed out by Adler (1989), much research is now trying to uncover more specialised aspects of the relation between structure and other organizational variables. Relying on that author's theorisation, four of these particularistic approaches will be briefly outlined: (1) communication, (2) cultural, (3) interfunctional relations, and (4) intrapreneurship perspectives.

2.2.2.2.2.2.1. A communication perspective

The importance of face-to-face contacts and information flows for new product innovation has been recognised for a long time as a relevant topic of interest: at least since the 1960s and due to the work of the MIT group built around Roberts, Allen, and Von Hippel (Adler, 1989; Brown & Eisenhardt, 1995a). These authors' work showed how much deviated from organizational reality the formally elegant algorithms for technology strategy formulation and project

selection could be (Adler, 1989) and started one of the two major theoretical themes on the perspective of communication as a fundamental variable for understanding new product development: the information processing view of new product development.

For the purposes of this work, the information processing and the resource dependence perspectives are not separated, since there are more things uniting than separating them. For ease of description, the information processing view can be presented as stating that the more a development team communicates, the higher performing it will be. The resource dependence view can be described as underlining the impact of political communication on development performance, a relationship that is bridged by the resource quantity and quality obtained by the team. However, these perspectives are not easily separated. It is not simple to differentiate technical and political behaviours: technical perspectives, emphasising the potential gains of a detected opportunity may have both a technical and a political component. An empirical study by Cabral-Cardoso (1995), involving 162 R&D managers from British companies, showed how the technical and political dimensions are simultaneously engaged in the decision process.

More research will be needed to conclude how formal and informal communication webs evolve, and what role the formal structure plays in this process. As pointed out by Pisano and Wheelwright (1995), informal relationships and approaches may be more appropriate for the management of innovation than formal structures and procedures. Future research should look for explanations to such a phenomenon. Theoretical deductions from the perspective of the science of complexity acknowledge the importance of this topic. According to this perspective, creativity and innovation are properties that can only be developed at the level of the informal structure (or shadow system, as Stacey prefers to call it), and not at the level of the formal structure (Stacey, 1995b).

2.2.2.2.2.2.2. A cultural perspective

As remarked by Peters and Waterman in their best selling book *In Search of Excellence* (1982), organizational culture can play a crucial role when it comes to stimulate innovation. The quest for the cultural contexts most favourable to organizational innovation is a long-standing topic of interest, whose origins can be traced back to the work of Burns and Stalker (1961).

Researchers have pointed out the importance of explicitly valuing innovation, of tolerating individual initiative, of rewarding those employees who successfully develop new things or new ways of doing things. This cultural orientation is in sharp contrast with the one prevailing in many organizations where managers are so preoccupied with protection of the existing business that they believe to not have the time to be concerned with new products. As pointed out by Wind and

Mahajan (1988) the development of successful new products depends, among other things, on the existence of product champions and top management support. Despite the consistency of research findings suggesting the importance of product champions, most companies develop cultures that inhibit their emergence and are unable and/or unwilling to reward their innovative behaviours.

One of the most comprehensive analysis of the importance of organizational culture to product innovation is that presented by Leonard-Barton et al. (1994). After having conducted several case studies of new product development in companies such as Kodak and Hewlett-Packard (HP), the authors concluded that the capacity to provide value to customers in the long run and under the form of new products, depends on the articulation of the following elements: (1) knowledge and skills, (2) managerial systems, (3) physical systems, and (4) values. The label 'values', including the dominant attitudes, behaviours, and norms could be substituted by the label 'culture' without damaging its meaning. As the authors point out, the values of the corporation, if aligned with the other three elements, are the most powerful determinants of a company's effectiveness. To illustrate this power, Leonard-Barton and her colleagues showed how the culture of HP created significant difficulties (in terms of cooperation and coordination) when its first personal computer was being developed.

2.2.2.2.2.2.3. An interfunctional relations perspective

One of the reasons most frequently accounted for explaining the origin of product failures, is the lack of integration between functions. This lack of cross-functional integration may be a consequence of the tactical view of the innovation process in organizations. As pointed out by Adler, Riggs and Wheelwright (1989), a strategic perspective must be adopted if firms want to succeed in product innovation, a perspective that recognises the complementary relations among the different functions involved, and that manages product development as a single, although multifaceted, process.

Dougherty and Heller (1994) clearly illustrated the undesired outcomes of tactical, compartmentalised thinking. By introducing the concept of illegitimacy, the authors noticed that in some large, established firms, the activities necessary for effective new product development, namely creative market-technology learning, working with people from other departments and openly interacting with senior managers, are not expected to happen in light of the current repertoire of thinking and behaving. This situation creates and reinforces the so-called thought worlds (Dougherty & Heller, 1994).

One of the most publicly held discussions about thought worlds in organizations is the R&D/marketing interface. It is practically unarguable that good relationships between marketing and R&D are an essential condition for product innovation success. In other words, technological advances are expected to be market-driven. Often, however, there is a long distance between normative theory

and actual organizational practice. As empirically found by Gupta, Raj and Wilemon (1985), marketing and R&D people often disagree about the ways to promote collaboration. The lack of trust between the parties is potentially damaging, with marketing people attributing to R&D the desire to develop technological pet projects, and being accused of over-focusing on short-term market opportunities. Considering that this lack of inter-functional co-operation is one of the causes that most significantly accounts for new product failure (Calantone & Cooper, 1981), researchers are trying to uncover the major causes and possible remedies to facilitate the marketing/R&D coupling. A clear separation of roles, reinforced by inappropriate structures, cultures and management practices, are among the most powerful obstacles to effective product innovation; knowledge sharing and collective problem-solving, in turn, are among the potential remedies (Souder, 1990).

One of the possible ways to overcome the risks of compartmentalisation, is to pay more attention to the concept of articulated demand (Kodama, 1995), and to promote organizational structures adequate to its effective management. One of such structures is what Adler and Zirger (1995) call the virtual technology and product development organization. This organization is made of cross-functional, cross-divisional product development teams that integrate R&D personnel and are structured for a specific project. The authors label this organization as 'virtual' because non-core membership is diverse and fluid. There is, however, a stable core development group. One of the major advantages of the virtual technology and product development organization is that it facilitates the development of core competencies (Prahalad & Hamel, 1990), because members communicate beyond traditional boundaries and join their knowledge and learning capacities. The virtual technology and product development organization can provide an effective operationalization of the concept of demand articulation, in that it actively tries to integrate the several activities connecting the customer, the developer, and the interpreter in the process of new product development. Adler and Zirger (1995) present as an example of the implementation of a virtual organization, the development of the F-22 long range fighter by the U.S. Air Force. The chances for organizational integration and information dissemination provided by the virtual organization are promising enough to deserve researchers' attention. Product developers' inability to understand and fulfil customer needs is eroding the competitiveness of many companies (Tushman, Newman & Romanelli, 1987). The virtual organization, given its sensitivity to the concept of articulated demand, may facilitate the integration of market demand and organizational competence.

Other authors have proposed different ways of overcoming the lack of collaboration and co-ordination, including: the return map and the creation of redundancy. Based on the experience of Hewlett-Packard, House and Price (1991) presented the return map. The return map allows ongoing monitoring of product innovation projects. In the Hewlett-Packard case, it portrays in graphical terms the impact of each member's contributions to product success in terms of

both speed and money. Intended to be a source of learning and improvement, it requires the joint collaboration of all team members in the interpretation of the integrative picture it provides. Other possible means to overcome 'thought worlds' is through the creation of redundancy. As explained by Nonaka (1991), the term redundancy often has a negative connotation among Western managers, being taken as synonymous of duplication, waste and inefficiency. According to the author, however, redundancy is important in the sense that, creating a 'common cognitive ground' (Nonaka, 1991: 102) it helps for dialogue and communication to emerge. There are many ways to build redundancy, namely through the overlapping of information, the rotation between functional and technological areas, and the free access to company information.

2.2.2.2.2.2.4. Intrapreneurship

The literature on intrapreneurship tries to uncover how organizations should be designed in order to bring the creativity and flexibility of small organizations into large companies. Two major lines of thought on this topic may be identified: one that considers that top management should be actively involved in the management of entrepreneurship, and other that is favourable to a more passive role of the top management team.

In the first line of reasoning, we can find the works of Jelinek (1979), according to whom the entrepreneurial process should be institutionalised; and, on a rather different position, the perspectives of Quinn (1979) and Peters and Waterman (1982) view top management as playing an active role in nurturing innovation, expressed in the form of risk-taking, tolerance with errors, etc.

Burgelman, on the other hand, seems to be in favour of a more passive role of management. His writings on the topic of internal corporate venturing (see Burgelman, Maidique & Wheelwright, 1996, for an overview), address the question of how big companies can become as innovative and flexible as small ones. According to the author, top management doesn't need to encourage intrapreneurship: it is only expected not to eliminate it (Burgelman, 1983a). This, however, is not an easy task: the multilevel character of organizational intrapreneurship, involving product-champions, organizational champions, middle managers, top managers, opposing coalitions, etc. makes it very difficult to avoid the strangling of innovative projects somewhere during the innovation development cycle.

More research is needed on the influence of organizational structure and process (politics, communication flows) on intrapreneurship, namely on how different structural formats facilitate or constrain innovation, or on how personnel practices (reward systems, work flows, leadership styles) act upon attempts to be innovative.

2.2.2.2.3. Internal group processes

This section refers to internal group dynamics. This internal focus does not intend to deny the importance of the external activities conducted by groups. The impact of external activities on new product development teams has been well documented in the literature (see Ancona, 1993 for a theoretical synthesis) and discussed under section 2.2.2.1.1. of this work.

Product innovation is a social enterprise. This social character is well expressed in the research on the relation between group dynamics and product innovation. Keller (1986), for example, in a study of 32 project teams, found that performance could be significantly predicted by the level of cohesion achieved by the group. This result evidences that a clear understanding of project teams is needed in order to understand how group dynamics affect product development performance. Katz (1982), in a study of 50 product development teams in a large corporation, concluded that an increase in performance with an increased mean tenure was followed, since the fifth year, by a performance decrease, which was significantly correlated with declining external communications.

Case studies on product innovation in Japanese companies alerted to the importance of cross-functional teams. Cross-functional teams, i.e. teams composed with people coming from diverse areas, looked more efficient in information sharing, and allowed the overlapping of development phases (Imai, Nonaka & Takeuchi, 1985). For speed and overlapping to occur, however, teams needed to engage in continuous interaction, so that constant awareness of each others' tasks becomes possible. The constant flowing of information between individuals and functions also worked for the creation of redundant information, which, according to Nonaka (1990), is of fundamental importance for effective product development.

Another area where product innovation and group dynamics intersect, refers to the importance of time. As will be discussed under section 2.3.2.2., time is becoming a central element in new product development. Increasing development speed may be facilitated if there is a good knowledge of how groups work. Empirical research conducted by Gersick (1988) with natural groups, showed that specific time-based objectives are powerful influences on the individuals composing these groups.

In a qualitative study of a product design consulting firm, Sutton and Hargadon (1995) concluded that group processes, in this case under the form of brainstorming meetings, provided relevant outcomes, including the diffusion of organizational knowledge, and the acquisition of new solutions for developing new products.

To summarise, group research on product innovation could be divided in two major research streams (Brown & Eisenhardt, 1995a): (1) an information processing perspective, that highlights the importance of frequent and varied communication flows, internal as well as external; and (2) a political perspective, that focuses on the process of resource allocation and the construction of organizational salience and legitimacy, namely through impression management.

2.2.2.2.4. Leadership

Leaders play a central role in building and managing effective product development teams. The role of senior management has been analysed by several authors and from different perspectives. Some authors (e.g. Gupta & Wilemon, 1990; Zirger & Maidique, 1990) emphasised the role of senior managers as being of primary importance for successful new product development. Other authors (e.g. Imai et al., 1985) referred to senior management role as one of establishing a clear and explicit organizational vision that sets the boundaries for group autonomy.

The role of intermediate level leaders has also been analysed. Clark and Fujimoto (1991), in their study of the auto-industry, mentioned the importance of heavyweight leaders, i.e. powerful team leaders that not only coordinate project groups, but also work with senior management in the creation of product concepts. These heavyweight leaders might play a decisive role in the transmission of the organizational vision (Imai et al., 1985) to lower hierarchical levels.

2.2.2.2.5. Organizational politics

Product innovation is deliberate action intentionally conducted by a collective of people. It thus involves power. Power is necessary to conduct and to facilitate the process. If one defines power as 'a force that affects outcomes', and politics as 'power in action' (Dougherty & Hardy, 1995: 2), then product innovation is an intensely political activity. The political component of innovation has been recognised by many authors, including Kanter (1983), Burgelman (1983a), and Frost and Egri (1991).

According to Dougherty and Hardy (1995), all the three dimensions of power – the power of resources, processes and meaning – are involved in the new product development process. Dougherty and Hardy conducted an in-depth study of product innovation in 15 bureaucratic organizations. They examined 40 cases of new product development, and interviewed 134 people from diverse functions, concluding that power served to stimulate stability and conformity, and not to foster innovation. This finding can be used as an explanation of why bureaucratic firms have so much difficulty in conducting product innovation on a permanent and systematic basis. In fact, in these firms, structures were not designed for innovation. There were difficulties, for example, in bringing departments

together, and in linking hierarchical levels. Some individuals were sometimes able to overcome these obstacles, but that was only due to their personal knowledge or experience, not to the system itself. Despite its occasional effectiveness, reliance on personal power to solve problems is risky for organizations: the capacity to solve problems and to develop innovative projects should instead be embedded in the system, which is not always the case.

Other investigations on the political component of new product development showed that overt political tactics are correlated with radical and autonomous projects, while covert political tactics are mostly associated with ideologically incongruent projects (Page, 1995).

2.2.2.2.6. Organizational knowledge creation and utilization

If they intend to renew themselves through product innovation, companies need to continuously create and exploit the organizational knowledge necessary for developing viable new products (Dougherty, 1992). As stated by Nonaka (1991), knowledge creating companies are those that are permanently acquiring new information, disseminating it throughout the organization, and embodying it in new products. The one and only lasting source of competitive advantage in an ever changing environment, Nonaka continues, is precisely knowledge creation. In line with Tsoukas (1995), we define organizational knowledge as knowledge used by people in organizations, which is therefore different from knowledge about organizations.

The view of organizational knowledge as a critical success factor, has also been noted by authors who refer that the lack of organizational learning represents one of the main causes of product innovation failure (e.g. Adler & Zirger, 1995). This lack of learning may be due to causes like inhibiting structures (Zirger & Maidique, 1990), and the difficulty of understanding action-outcome relationships (Duncan & Weiss, 1979), and it can be removed through several ways. Huber (1991) identified three activities that facilitate organizational learning: knowledge acquisition, information distribution, and information interpretation. As this set of activities makes clear, organizational learning and knowledge creation do not only refer to the stocking and flowing of information, but also to 'the stock of a firm's expertise' (Bierly & Chakrabarti, 1995: 3).

An empirical study in which Bierly and Chakrabarthi (1995) used new product development as a measure to better understand the dynamic capabilities approach, may shed some light on the relation between new product development and long term supernormal profits. The dynamic capabilities approach is an extension of the resource-based view of the firm. The difference between these distinct yet complementary approaches lies in the fact that while the resource-based view states that a firms' resources will be a source of competitive advantage to the extent that they are valued, rare and not-substitutable (e.g. Wernerfelt, 1984; Barney, 1991; Day, 1994), the dynamic capabilities approach emphasizes less the

organization's stock of resources and more its ability to continuously upgrade products and technological solutions that are not easily matched by competitors (e.g. Prahalad & Hamel, 1990; Kogut & Zander, 1992). Considering that, as noted by Bierly and Chakrabarti (1995), no tangible asset or market position can serve as a long-term source of competitive advantage (because of imitation or obsolescence), the single way to achieve long-term competitive advantage is through organizational learning, i.e., by acquiring or creating new knowledge, disseminating it throughout the organization and translating it into new, superior products, or into new, superior ways of producing current products. Bierly and Chakrabarti's analysis of 21 pharmaceutical firms during three five year periods, indicates that technological learning is a key driver of product innovation. The relationship between technological learning, strategic flexibility and new product development, however, is a complex one, which suggests that a simple moderation model does not fully capture the relationships between these variables. One of the most significant conclusions of this research is the fact that it highlights the necessity of organizations to develop knowledge strategies. These strategies should be built if a firm intends to remain flexible enough to incorporate and apply new knowledge. This knowledge strategy should also define how broad its knowledge base should be, taking into account that the broadening of a firm's knowledge base should not be made at the expense of the firm's core competencies.

A dynamic perspective on the role of core competencies will show that they may have a down side if they get so revered that they turn into core rigidities (Leonard-Barton, 1992). For avoiding the risk of incurring in core rigidities, organizations should thus create the requisite variety (Van de Ven, 1986) that is able to disturb the old state of fit (Chakravarthy, 1982). The creation of requisite variety may come under the form of new product development projects, as micro social systems that defy the macro organizational system, inducing the creation of managerial paradoxes (Leonard-Barton, 1992). The coexistence of multiple organizational frameworks, in turn, may be a facilitator of organizational renewal, which means it is a perspective congruent with the multiple horizon organization, to be presented in section 2.5.3.

New concepts are being introduced to develop our understanding of the relationships between product innovation, organizational creation and utilization of knowledge, as illustrated for example by the concept of information stickiness, or the degree to which the information necessary for problem solving is hard to acquire, to transfer and to utilise in another place than that of origin (Von Hippel, 1994).

2.2.3. Launching finished products

System dynamics research showed that one way to improve an organization's performance is through minimising system delays (Stata, 1989). This is well

known today in what refers to development time, but may also be true in responding to information fed-back from the market.

New product launch is of fundamental importance for new product success because of several reasons, namely because the superior characteristics of a new product must be communicated to the market, and the analysis of the diffusion process may be a valuable tool for learning about the market, for improving the product, and for managing product portfolios.

Developing, launching, and accompanying new products in the marketplace are not independent activities but complementary steps of a threefold process. The literature on new product development, however, has often disconnected these sub-processes, making it difficult to cumulate integrative knowledge about the transitional phases in new product development.

The vast literature on the diffusion process must consequently be more closely articulated with the development process itself. The diffusion process can then be outlined as including not only the characteristics of the innovation, the characteristics of the adopting individual or organization, the information processing characteristics of the potential adopter, network participation, and competitive environment of the adopter (Frambach, 1995), but also the way these characteristics impact the decision to adopt or not to adopt, and influence the actions of the diffusing organization. This bi-directional approach to the process seems to be a necessary condition for improving the theory and practice of new product launch and diffusion.

2.3. MODELS AND TRENDS IN PRODUCT INNOVATION

This section is composed of two subsections. In the first subsection, the existing models of new product development will be briefly described; in the second subsection, recent trends in new product development will be presented in order to illustrate how the emerging competitive environments are changing the shape of product innovation activities.

2.3.1. Product innovation models

Product innovation models are moving in the same direction as organization science in general, i.e. they are moving from a strictly mechanistic to a complexity perspective (Stacey, Fonseca & Cunha, 1996). This evolutionary trend seems to be a fruitful one, considering that traditional models of new product development are often idealised. It is then without surprise that few similarities often exist between ideal models and the organizational 'firing line'.

For example, Cooper and Kleinschmidt (1986) have built a prescriptive model of new product development composed of thirteen successive activities: initial

screening, preliminary market assessment, preliminary technical assessment, detailed market study/market research, business/financial analysis, product development, in-house product testing, customer tests of product, test market/trial sell, trial production, pre-commercialisation business analysis, production start-up, and market launch. They found that commercial success was more likely to happen if all the thirteen activities were correctly handled. Such a finding has been empirically confirmed in an Australian investigation conducted by Dwyer and Mellor (1993). However, and despite the consistent information collected, Cooper and Kleinschmidt (1986) also found that only a small minority of the companies surveyed accomplished, in fact, all the thirteen development steps.

This section will try to dissect some of the reasons accounting for the gap between product innovation models and actual product innovation practice. In order to do so, four different models of new product development will be presented. As will be seen, there are huge differences in their underlying assumptions and recommended practices(see Table 2.3 by the end of section for a summary). To put it in other words, they are as diverse as the technical language of traditional models (e.g. Crawford, 1991) and the poetic language of Japanese new product development models (Nonaka, 1991). After presenting the models, two of the reasons that are possibly triggering the move from formal to intuitive approaches will be discussed: the need for faster development processes and the changing role of planning in organizations.

2.3.1.1. Step-by-step model

The sequential, step-by-step approach to new product development, constitutes the dominant way of theorising about product innovation. Step-by-step models are process templates built to quickly and efficiently develop new products. These models are rational tools intended to guide the decisions of product managers across the entire process. Consequently, they may be suitable for managing programmed but not for non-programmed (Zaltman, Duncan & Holbek, 1973) innovations. They are expected to reduce the uncertainty inherent to innovation (e.g. Dosi, 1988), through the suggestion of a set of rational decisions to be made one after the other.

Step-by-step models rely heavily on planning, a finding which is not surprising, in the case of a rational model. These normative and rationalist approaches to organized action, however, do not seem to fit the way organizations really work: as reported by Cooper (1988a), only less than 1 per cent of the firms studied do actually make use of a complete stage-gate approach. In the remaining of this section, some reasons will be presented, which help to understand why companies do apparently resist a procedure that appears to be so beneficial.

Step-by-step models can be viewed as 'tools to manage, direct, and control (...) product innovation efforts' (Cooper, 1990: 44). To phrase it differently, they are corporate tools for the rationalisation and control of product innovation. Step-by-

step models are not learning or creativity tools. They are mechanisms of organizational control, which suggests that they may be most appropriate to small, incremental innovations, than to radical innovations or to innovations that deviate from the current courses of organizational action. The definition of tight steps to follow while developing new products, will possibly inhibit those innovations that require unexpected and unplanned courses of action, that is, radical or breakthrough innovations. These innovations are not expected to be accomplished 'by a simple application of programmed switching rules' (March & Simon, 1958: 175). One of the dangers inherent to these models, therefore, is the creation of habits of mind (Louis & Sutton, 1991), automatic answers to problems that may require learning and flexibility of response. The physical as well as social separation of activities suggested by sequential models also appears to work against learning, because, as suggested by diverse authors, social interaction – facilitated by physical proximity – is a fundamental means for achieving the creation of organizational knowledge (Nonaka, 1994; Tyre & Von Hippel, 1995). This conclusion clearly illustrates that the idea of expertise as something that people carry in their heads (Tyre & Von Hippel, 1995) is debatable. Expertise, combining cognitive as well as social and physical dimensions, can be facilitated by avoiding isolation and segmentalist thinking (Kanter, 1983). Last but not the least, some organizations may decide not to follow the complete set of instructions provided by step-by-step approaches, because the model may not be adequate to the kind of product they are developing. In the case of banking product development, for example, the technical development phase may be greatly reduced or absent, while in the case of manufacturing companies, this is the most time-consuming and costly phase of the whole new product development process (Meidan, 1984).

Step-by-step models have advantages as well. According to empirical evidence collected by Cooper (1993), these models can be powerful instruments for developing systematic and comprehensive product innovation practices. There is a strong argument for adopting sequential approaches to product innovation: they provide a clear-cut, relatively simple, and thorough set of guidelines for developing new products, which seems to be more appropriate than having no systematic approach to product innovation (Cooper, 1988a). This road map, however, does not seem to be a universal solution. Some situations, namely radical innovations, may require different approaches to product innovation. These approaches will be examined in the following subsections.

2.3.1.2. The compression model

The compression model can be viewed as a version of the step-by-step approach tailored to high-speed environments. As in the previous model, the development steps form the basis for developing new products. However, due to market pressures and the competitive importance of time (Stalk, 1988) these steps sometimes need to be accelerated, or compressed. There are several ways for achieving compression: improving planning, simplifying the process, eliminating

unnecessary steps, involving suppliers, shortening the completion time of each step, overlapping steps, and rewarding people for speed of development (Eisenhardt & Tabrizi, 1995). The crucial moment in the compression strategy is planning: if pre-development planning is accurate, the entire process may be rationalised, delays eliminated and mistakes avoided. Careful planning may be at the basis of quick development. Deficient planning can be at the origin of numerous product pathologies such as stop gaps and disruptive reorientation (Brown & Eisenhardt, 1995b).

The compression model is somewhat similar to Cooper's (1994) suggestion for parallel processing of the activities involved in new product development. This paralleling of activities tries to encompass the advantages of sequential models with the demands for a faster process, suggesting that development tasks can be undertaken simultaneously instead of following a rigid relay-race development process. This perspective intends to keep the uncertainty-reduction aspect of step-by-step models while recognising the need to save time. Consequently, it stands for the need to invest in planning in order to gain speed. If there is enough speed, the process could be rationalised: unnecessary tasks will be removed, time spent on each task will be reduced to the minimum, interactions between team members will be regulated, and some tasks could be delegated, namely to suppliers.

The compression model assumes, in a way similar to the traditional model, that development activities could be known in advance, and that product innovation models are expected to reduce the uncertainty inherent to the innovation process. By recognising the need to speed up processes, it tries to shorten the model as much as possible, compressing some activities, overlapping others, and removing those that are not strictly necessary.

Given the links between step-by-step and compression models, it is without surprise that both are said to rely on planning and certainty. The compression model can be adequate for developing products that demand the use of known technology and are directed towards familiar but high-speed markets (Eisenhardt & Tabrizi, 1995).

2.3.1.3. The flexible model

Turbulent environments with uncertain developments may suggest the utilization of a third model for developing new products: the flexible model (Iansiti, 1995a). The flexible model tries to keep a general, loose structure for product development, but it incorporates some of the intuitive, emergent characteristics that will be found in the improvisational model.

The central argument of the flexible model is that the speed of change forces companies to adopt product development models radically different from those that prevailed in the past. In the case of the flexible model, innovation is seen not as a threat to remove but as an opportunity to embrace. Consequently, instead of

encapsulating the process, the flexible model tries to accommodate it to change and to the shortening of product life cycles. Simply put, the flexible model is based on keeping the concept development stage open as long as possible. Rejecting the idea of product development as a rigid sequence of phases, the flexible model argues for the use of 'rapid and flexible iterations through system specification, detailed component design, and system testing' (Iansiti, 1995a: 2).

The main difference between this and the previous models relates to the rejection of a central dimension of these models: the idea that each phase should follow another, and that this sequencing is the most appropriate path for generating new products. The flexible model adopts a more dynamic perspective and assumes that the concept development phase should be left open (or 'unfreezed') as long as possible so that a company diminishes the risk of launching a new product that is out-dated as soon as it reaches the market.

If the business environment is unpredictable and characterised by rapid change and aggressive competitors, the company should try to incorporate market information for the longest amount of time. The idea is to delay the moment of concept freezing as long as possible, considering that it will not increase the total lead time. When the product concept is frozen, the window of opportunity gets closed and newly acquired information could no longer be incorporated in the product.

The flexible approach is iterative by nature in the sense that product concept and design are perfected whenever new information is acquired. This approach not only implies the resolution of different functions during each phase, but it also promotes phase overlapping, which means that concept and design are developed simultaneously and not sequentially. The model tries to establish fluid communication links between people participating in the project, so that any change in the product concept could be immediately translated into the corresponding change in design. The detection of any inconsistency in product design – through the use of prototypes or simulations – should give place to an immediate correction in the product concept, and so on, i.e., iteratively.

This model intends to approach the concept freeze milestone as much as possible to the market introduction milestone (the moment in which the product concept is definitely established). It implies the overlapping of stages so that the product concept and its detailed design are developed simultaneously. It provides a way for incorporating new competitive information in the product concept at a relatively later stage, which means that it is a more porous and permeable model for incorporating real-time information than the previous models. This model seems to be especially appropriate for product innovation in highly volatile environments, those environments that change so quickly that a new product risks becoming outdated even before reaching the marketplace. The effectiveness of the flexible model (as well as the improvisational model, to be presented in the next section) is largely dependent upon the integration of activities achieved by

the organization: more volatile organizational environments (like those that stimulate the use of less certainty-prone models of product innovation) makes integration of activities more important as well as more difficult to achieve (Miles & Snow, 1978; Shrivastava & Souder, 1985).

2.3.1.4. The improvisational model

Several authors claim that contemporary organizations need to adopt new configurations so that they become able to respond to an environment that requires more flexibility. One of the suggested directions to gain such flexibility is through the adoption of a 'jazz design', i.e. to learn from jazz bands how it is possible to be simultaneously focused and innovative (Pasmore, 1995; Kamoche & Cunha, 1997).

The improvisational model (Eisenhardt & Tabrizi, 1995) is intuitive and emergent by nature and based upon the notion of uncertainty. It tries to help teams to innovate under shifting and unfamiliar conditions. When markets and/or technologies are not familiar, the development paths used in the previous models may not be flexible or responsive enough. Under what circumstances is the use of the improvisational model appropriate ? Under those circumstances that lead to the failure of models based on the assumption of predictability: in some industries, a decision made in the morning may be outpassed and needing to be corrected in the afternoon (Nonaka, 1988). This amount of decisional flexibility is allowed by the improvisational model but not by more sequential and ordered models, in which decisions are irreversible. The major potential strength of improvisational models lies in the fact that they facilitate the emergence of flexible behaviour and promote adaptiveness to actual, non-predictable, circumstances.

Based, among others, on the concepts of improvisation (Moorman & Miner, 1995), sensemaking (Weick, 1993), and chaos (Quinn, 1985), the improvisational model provides a framework for developing new products under uncertain conditions, for which planned courses of action may be inappropriate. Clear role structures, flexible options and intuition, are at the basis of the use of the improvisational model, an approach that balances control and ad hockery: development teams are allowed to work autonomously inside the limits established by the vision of objectives. If the balance between autonomy and control is, as pointed out by some authors (e.g. Clark & Fujimoto, 1991), the main challenge to product development in today's firms, the improvisational model constitutes a pragmatic way of putting this balance to practice.

If the process to develop and the outcomes to achieve are not easy to know *a priori*, a possible solution for the development of new products is through frequent iteration (Eisenhardt & Tabrizi, 1995). The reason why frequent iterations can work in unpredictable environments is because they create more opportunities and probabilities for innovation to occur: as pointed out by Tsoukas

(1993: 514), 'making comes before matching; variety comes before selection'. Organizations can develop simultaneous alternative designs, iterations of previous designs or some combination of the two. Iterations may shorten product development time because they promote multifaceted knowledge of the same product. It is expected, however, that this approach also produces higher levels of failure than the previous approaches. These failures, as paradoxical that it might sound, can be beneficial, if they provide information and opportunities for learning that could not be obtained without experience (Sitkin, 1992).

Some additional advantages of the improvisational model relate to the fact that it favours and encourages learning by doing (Anzai & Simon, 1979) and interfunctional communication, supported by extensive multifunctional training. Developing and testing activities helps to uncover, in an early phase, aspects of the design that are not appropriate and reduces the psychological over-attachment to the project, which in turn may avoid escalating commitment to a chosen course of action (Staw & Ross, 1987). The evidence collected from multiple testing, accelerates learning from early evidence (what mistakes to avoid, what advantages to explore), which facilitates the acceleration of the development process. By putting different groups in close contact with each other, the improvisational approach to product innovation may also facilitate the overcoming of interpretative barriers to product innovation in a much more effective way than the sequential, segmentalist approach stimulated by step-by-step models (Dougherty, 1990).

The use of the improvisational model may also entail some risks. As reported by Dess et al. (1995), product development time can more than double when a company adopts a team-approach, which suggests that the transition from hierarchical to more participative, less ordered organizational arrangements, may provoke some turbulence and transitional challenges. Additionally, it demands the creation of redundant information, the acceptance of ambiguity, and the need for constant refocussing, which are not easy to tolerate in more bureaucratic, control-oriented organizations.

Table 2. 3
Key characteristics of product innovation models

	Step-by-step	Compression	Flexible	Improvisational
Enacted environment	Mature, relatively stable	Well-known, high speed	Turbulent, high speed	Unpredictable, high speed
Assumptions underlying the model	Buffering the process from unnecessary change and uncertainty	Rationalising the process as a way of adapting	Embracing change, absorbing uncertainty	Substituting planning by doing
Process characteristics	Structured, with clear phases and sequences, planned, closed	Predictable series of discrete steps, compressed or removed according to necessity	Partly emergent, partly planned	Flexible, open, iterative, emergent
Process goals	Efficiency, predictability, mechanisation	Increasing speed while keeping low levels of uncertainty	Flexibility, responsiveness	Coping with unclear environments, adaptiveness
Key organizational Functions	Introducing discipline and control, evaluating each phase	Rewarding speed, emphasising planning, using multifunctional teams	Joint evolution of process and product design.	Managing stress, facilitating sensemaking, providing vision and strong leadership
Fundamental assumptions about organizing	Certainty, equilibrium, stability, predictability	Certainty, equilibrium, stability, adaptiveness	Uncertainty, unstable equilibrium, bounded instability, adaptiveness	Uncertainty, complexity, bounded instability, self organization
Current shortcomings	Rigid, time consuming, fitted to long cycle products, vulnerable to crystallisation and centripetal forces, risk of 'missing the boat'	The traps of acceleration: lack of quality, shortcuts, omission of important steps	The 'might as wells' syndrome can provoke serious delays, due to unfreezing product concept	Fuzzy, unclear, ambiguous process; vulnerable to disintegration and centrifugal forces, risk of 'sinking the boat'
Metaphor	Relay-race	Accordion	Rugby	Jazz

2.3.2. Emerging trends and directions in product innovation

As predicted by contingency theory, changes in organizational environments seem to be forcing organizations to accommodate their processes to those changes (Applegate, 1995). In this section, two emerging topics of central importance to new product development in the 1990s, will be highlighted: (1) the changing role of planning in organizations; and (2) the growing importance of development speed.

2.3.2.1. The changing role of planning

Traditional product development models highlighted the importance of planning for product innovation success. As pointed out by Cooper (1993), product development planning is a critical factor for new product development performance. This position has its roots in the traditional conception of planning as a symptom of rationality, as expressed by the statement 'organizations must plan to be 'rational'' (Mintzberg, 1994: 18).

The conventional view about the nature of planning, however, is a risky one, in that it relies on a static conceptualisation of plans and planning: it assumes that innovation can be planned and controlled, when in fact and as described by one R&D informant to Burgelman and Sayles (1986: 58) 'A prescribed route is always bad for scientists. Invention and scientific work are inherently serendipitous'. The rational perspective considers that companies are able to characterise the environment, to forecast the future with a certain degree of detail, and that, based on these characterisations, they are in a good position to define how they will approach the market. This formal perspective of innovation, however, coexists with the recognition of two complementary facts suggesting that rationality is not the solution for every organizational problem: (1) non-programmed, emergent forms of innovation do sometimes constitute a fundamental means for organizational renewal to occur; this kind of innovation is often named 'bootlegging' and consists of research that is not formally approved by the organization but that is tacitly accepted and sometimes even encouraged (Burgelman & Sayles, 1986); (2) rationality is not an inherently good thing, although it is often assumed to be so. If there are positively-biased terms in the organizational literature, two of them are innovation (Kimberly, 1981) and rationality. If planning systems become too rational, however, they start working as barriers to adaptiveness, promoting excessive levels of normalisation, inflexibility, inertia, and an overemphasis on quantitative information. As found by Lenz and Lyles (1985), excess of analysis can lead to paralysis.

The previous observations help to explain why companies are looking for different kinds of planning. As pointed out by Adler, Riggs and Wheelwright (1989), companies facing dynamic environments still need planning, but not the kind of planning that attaches a company to the detailed itinerary referred by Hayes (1985). Planning for hyperturbulent environments (McCann & Selsky, 1984) should work not as a pre-programmed series of steps to follow but as a sense of direction (Adler et al., 1989), that provides strategic guidance while allowing operational flexibility. Without a rigid planning of activities, companies are more apt to detect opportunities, to experiment with the possible futures, to act in genuinely creative ways.

As stated by Hedberg, Nystrom and Starbuck (1976: 59), 'an organization should plan its future but not rely on its plans'. To put it another way, organizations should have minimal faith in their plans. Plans should be expected, among other

things, to be useful on appraising possible future environments, on reacting timely but in a way consistent with the strategy, on securing people about the future. They should not be so detailed that they discourage reaction and make their own substitution problematic.

The kind of long term thinking facilitated by flexible planning, makes it easier to manage new product projects in a more integrated and articulated way through the use of new product development maps (Wheelwright & Sasser, 1989). Product maps are helpful because they provide a general perspective of the evolutionary path of successive product generations, making it easier to introduce corrections, given that a broad overview of successive product generations becomes possible.

2.3.2.2. Speeding the process

To date, most research on product innovation has taken financial results as the preferential measure of product success. Recently, however, researchers and managers are becoming more concerned with speed, which may be due to the fact that time-based competition is apparently emerging as a highly valued competence in new business environments (Stalk, 1988). Recently, a growing number of authors are choosing speed of development as a central measure of product innovation, complementing financial results. Speed of development can be defined as the period of time elapsing between the idea for the new product and the market launch of the new product. There are at least two immediate reasons for this refocusing: (1) the profits generated by speed of development; and (2) the shrinking of product life cycles. Nayak (1991) described how the construction of a financial model of product development, in which the base programme had a lead time of 5 years and a net present value of about 2 billion dollars, led to the conclusion that the reduction of new product development lead time by 20% (one year) increased the net present value by almost 350 million dollars. In this case, the manufacturer would gain almost 7 million dollars for every week saved from development lead time.

'Fast track' companies (Gehani, 1992), those companies able to cope with the high-speed environments (Eisenhardt, 1989) in which they operate, can achieve several benefits if they are able to accelerate new product development. These include benefits of efficiency, namely by lowering cost through the reduction of man-hours and overhead (Cordero, 1991), premium prices that early entrants can charge (Millson et al., 1992), shareholder wealth gains (Lee et al., 1995), the prestige arising from pioneering a new product introduction (Fox & Vaaler, 1995) and, last but not the least, increasing competitiveness by diminishing the time of response to market needs (Cordero, 1991). It can also help the company to avoid some risks, namely opportunity costs (related to slowness), while potentially increasing development risks, that is, risks associated with technology development (Krubasik, 1988). The trade-offs between risks and opportunities provided by speed are also illustrated by the 'missing the boat' and 'sinking the

boat' metaphors developed by Dickson and Gigleriano (1986). As colourfully illustrated by the authors, there are two major risks facing new product development firms: (1) the risk of taking the wrong opportunities, i.e. of 'sinking the boat'; and (2) the risk of not taking the right opportunities, i.e. of 'missing the boat'. New product development literature has traditionally devoted more attention to the risk of sinking the boat, thus developing diagnostic tools to help managers decide what opportunities to take. The shortening of product life cycles, however, is stimulating a refocusing of attention: the need to innovate faster is colliding with the use of very detailed and time-consuming diagnostic tools. As pointed out by Abell (1978), there are only limited periods during which there is an optimum level of fit between an organization's competencies and market requirements. Very time-consuming diagnostic tools may increase the risk of 'missing the boat', or of losing opportunities by letting windows of opportunity getting closed.

It is interesting to note that Japanese firms seem to have developed a better understanding of the impact of speed on organizational outcomes: as shown in a study of Mansfield (1988) that contrasted American and Japanese companies, the later invested twice as many resources for speeding new product development.

The need for speeding up product innovation led several authors to look for available techniques for reducing the developmental cycle time of product innovation. Millson, Raj and Wilemon (1992) found five generic approaches to acceleration: simplification, elimination of delays, elimination of steps, speeding up operations, and paralleling the process. According to the authors, companies can utilise these approaches alone or in combination. Cordero (1991) proposed the following time-saving techniques: making speed a central goal of the firm, selecting faster product strategies, managing for the speedy implementation of faster product strategies, managing people for speed.

Many authors have proposed several ways for speeding new product development: Gomory (1989) suggested the use of frequent incremental innovations, design for manufacturing and the use of external sources of technology; Gupta and Wilemon (1990) recommended the avoidance of poor product definitions, technological uncertainty, lack of senior management support, lack of resources, poor project management; Mansfield (1988) referred to the use of external technological sources and the investment of resources in the reduction of development time; Takeuchi and Nonaka (1986), based on the experience of six projects from large Japanese companies, suggested to built-in instability, self-organizing project teams, learning across levels and functions, subtle control and transfer of learning; Clark and Fujimoto (1991) considered the importance of process integration, customer integration, design for manufacturing, and smaller project scopes; Eisenhardt and Tabrizi (1995) highlighted the characteristics of the experiential model, namely multiple iterations, extensive testing, frequent milestones, and a powerful project leader.

For quick response product development processes to result, McDonough and Spital (1984) alerted to the fact that some requirements must be met: high organizational visibility should be assigned to the project, reflecting a sense of urgency; constrained product development, focusing more the marketplace than on technological state-of-the-art; and a combination of engineering and marketing skills, achieved by attributing project leadership roles to engineers with a business outlook.

As the list of the options available for reducing product development time may have suggested, proposals from different authors show a substantial overlap. Considering that strategic, tactic and operational approaches are to a great extent mixed up, there is now the need for developing more integrative and comprehensive approaches for speed. Being widely accepted that several of the approaches proposed may be used simultaneously, it is lacking a general framework that integrates approaches from the different levels of analysis, that suggests what approaches do make conceptual and applied clusters, and how some techniques may be grounded by prior preparing interventions. Two examples: rewarding speed (Eisenhardt & Tabrizi, 1995) does probably need anticipated action at the level of human resources strategy (Cordero, 1991), while the reduction of time-to-market requires investments on R&D not only for products but also for processes, once that inadequate processes may cause significant delays to occur before a new product is launched (Pisano & Wheelwright, 1995).

Before closing this section, it is worth noting that acceleration entails not only benefits but also some risks. Among these risks, one can consider the misinterpretation of acceleration for 'real' growth and the risk of disrespecting the natural rhythm of a product's life cycle (Von Braun, 1990). The new-car buyer, for example, wants it to be up-dated for a reasonable amount of time.

To conclude, and building on Kessler and Chakrabarti (1995), some weaknesses can be pointed out in the literature on speed of product innovation processes. The main criticism refers to the lack of theoretical consistency of the literature: most research efforts make cookbook prescriptions that result in loosely-connected theoretical models (if any); relationships between variables are not systematically assessed; the terminology and the measurement of variables are not consistent throughout the literature. In consequence, contradictory prescriptions arise, probably as a consequence of the lack of systematic testing of relationships.

Researchers analysing this topic, usually try to build normative models of how to accelerate product development. Several approaches have been considered. Gupta and Wilemon (1990), based on the suggestions made by 80 executives, referred, for example, to the involvement of customers and suppliers, the use of teams, and the visibility of top management support.

2.4. THE ANATOMY OF THE PRODUCT INNOVATION PROCESS

Practising managers and scholars are equally interested in the development of normative models that may provide a few principles for developing new products. One of the best known results of this effort is the NewProd model, intended to screen, evaluate, and diagnose new products (Cooper, 1992). This section will rely on these and other findings, in order to summarise research on the new product development process.

2.4.1. Pre-development

The new product development process can begin in one of two ways: it can be a technology-driven or a market-driven process. The first approach is usually referred to as technology-push or supply-side driven, the second as market-pull or demand-side driven. Much debate has revolved around these questions. As discussed under sections 2.2.1.1. and 2.2.1.2., the market versus technology debate does not seem to be the crucial one: the important point to discuss refers to the way an organization assesses the likelihood of success of its new products. To make this assessment, in the pre-development phase there are several actions available. In this section, they will be briefly outlined.

2.4.1.1. Market-driven new products

As pointed out by Cooper (1988b), the chances of a new product's success are firstly determined in a very early phase of development, or more precisely, in the pre-development phase. After having conducted an analysis of 203 industrial product launches, of which 123 were successes and 180 were failures, Cooper concluded that pre-development activities appear to predict new product success. The empirical evidence collected, however, showed that on only a quarter of the projects reviewed, a detailed market study did take place, while steps like initial screening, preliminary market assessment and detailed market study were judged as some of the most deficiently conducted actions of the whole new product development process.

Pre-development activities include three main stages: (1) idea generation and screening; (2) preliminary assessment; and (3) concept definition. In the remaining of this sub-section, the discussion will turn to how these phases can be conducted.

There are several ways to improve idea generation, namely listening to customers, using sales groups, utilising creativity sessions, and developing suggestion schemes. All these forms can yield more ideas from where to develop new products; the main advantages related to their utilization refer to the fact that they allow a proactive stance in new product development. Most of the emerging ideas, however, are not worth further development. It is then important to carefully develop the second phase, idea screening.

Screening, according to the definition of Cooper (1988b: 242), can be viewed as 'a tentative decision to commit initial and limited resources to an embryonic project in order to prove the project's viability and potential'. Screening is a decision to undertake the initial stages of a process that may or may not lead to the complete development of the project. It is then a preliminary evaluation, intended to separate potentially winning from potentially loosing projects. Several tools can be used to handle initial screening: economic models, portfolio optimisation models, benefit contribution models, checklists, and scoring models.

A second stage of pre-development activities, is preliminary assessment. This stage involves three different sub-stages: a preliminary, low-budget market assessment, aiming to collect as much information about the market as possible; a preliminary technical assessment directed toward a first evaluation of the technical viability of the product, and a second, more fine-grained evaluation of the project, resulting in another go/kill decision.

The third and last pre-development stage, concept definition, involves four sub-stages: concept identification, concept development, concept test, and concept evaluation. The concept identification stage tries to determine the features of the best product in the eyes of the customer. It evolves through frequent interactions with potential users, and may be developed by the use of techniques like focus groups, large surveys, in-depth meetings, and observation of how potential adopters use competitors' products. Concept development consists in the operationalization of the concept into a technically and economically feasible new product. Concept test is a final pre-development test which tries to analyse if the envisioned product will in fact be able to provide value to the customer. The last pre-development stage is concept evaluation, a sub-stage in which it will be decided if the product will enter full-scale product development. If the decision is to 'go', a project protocol may be determined. As presented by Crawford (1984), the protocol is an agreement between the marketing and technical departments, that serves as a guide for all the development project. The protocol specifies the product concept, the target market, the product positioning, the product benefits, and the product attributes and requirements.

2.4.1.2. Technology-driven new products

Research conducted by Iansiti (1992, 1995b) on the development of products based on novel technologies, illustrated the importance of the 'technology integration' concept. The technology integration concept emphasizes the importance of a systems focused approach for the management of technology. By a systems focused approach, the author refers to the need for accumulating 'system-level knowledge of product and production process over multiple project generations, and for the direct application of this knowledge base into the process for the selection and refinement of technology' (1995b: 259).

As Iansiti's results suggest, technology integration may be expected to lay at the heart of speed and efficiency in new product development. It means that even before the beginning of the development process, several critical activities aimed towards technology integration must have been accomplished, namely technology selection, and the definition of the technology concept for the next generation. Therefore, the concept of technology integration is more complex and inclusive than the concept of technology transfer (e.g. Allen, Tushman & Lee, 1979), in that it articulates the past with the future, and thus facilitates managing in time, a characteristic referred by Brown and Eisenhardt (1995b) as being of fundamental importance for the management of product portfolios.

Iansiti's results show that the management of new, technology-driven products, is more than the result of strategic planning and project management: technology evaluation, selection, and integration can make a difference, as shown by the striking differences between the productivity averages of Japanese and Western firms.

2.4.2. Development

Inspired by Craig and Hart (1992), this subsection will be divided in three topics: new product development activities, new product development proficiency, and the reduction of development times. As this last topic has been analysed in a more detailed manner in section 2.3.2.2., it will be referred only marginally.

2.4.2.1. New product development activities

Product development has traditionally been viewed as a linear, straightforward process, made up of a succession of stages that are implicitly or explicitly presumed to start and to finish in the marketplace. Models such as those presented by Kotler (1988) and Cooper (1993) are good illustrations of this point.

As these models have been already presented (see section 2.3.1.), the rational and exhaustive template for developing new products will not be discussed here. Suffice it to say that the general acceptance of the technical superiority of these models is now being challenged by recent emergent approaches, which are suggesting that minimal structures and experiential/improvisational approaches can add flexibility and capacity of response to the process, by accepting and accommodating the uncertain and unpredictable nature of every innovation process in the development template.

Factors like intuition, sensemaking, and speed, are stimulating academics to develop new theoretical models, more sensitive to the organizational realities surrounding new product development, with its amalgam of politics, emotions, bounded rationality, perceptual bias, loose coupling goals, etc. In sum, product innovation models are no longer uncertainty reducing models, but uncertainty-

accommodating models, potentially more adequate to the characteristics of emerging business environments (Bettis & Hitt, 1995).

2.4.2.2. New product development proficiency

Despite the empirical evidence collected that argues for the advantages arising from judiciously following all the steps involved in the new product development process, the truth is that most projects do not follow the set of stages recommended, among other authors, by Cooper (e.g. 1993). Several reasons may account for this 'disrespect' for the prescriptions of stage-gate processes: (1) these recommendations are not known by those responsible for project development; (2) some situations, like product improvements or product modifications, may invite companies to skip some steps of the process; and (3) the demands for speedy development counteract the recognition of possible benefits arising from very analytic and sophisticated new product development processes.

2.4.2.3. Reduction of development times

Time-based competition appeared in the late 1980s as a consulting package resulting from the observation of practices of some successful Japanese companies (Lillrank, 1995). Some of time-based management tools, like simultaneous or concurrent engineering, became very popular in Europe and North America.

The implications of time-based competition for new product development are obvious, as expressed in the recent development of models that aim to accelerate product innovation without damaging the rigour and the effectiveness of the process. Japanese influences on new product development models are visible in the overlapping of stages (Takeuchi & Nonaka, 1986). The overlapping approach takes *sashimi* as a metaphor, i.e. that can be portrayed in the same way the slices of raw fish lie in this typical Japanese plate.

Despite its continued and strong interest in the new product development field, time-based competition lost some of its reputation in the beginning of the 1990s, partly due to the association between speed and the falling profitability of Japanese firms. Reengineering substituted time-based competition as the preferred buzzword of Western executives. However, the economic benefits apparently arising from fast new product innovation, may help to maintain professionals and scholars interested in the topic, as discussed in section 2.3.2.2.

2.4.3. Launch

All the effort put in developing a new product will be worthless if the product is not conveniently launched and diffused.

In a case study of a successful financial development, Edgett and Jones (1991) remarked that correctly managing the delivery phase was critical to product success. Two aspects, in particular, have been explicitly addressed: the staff should be properly trained and the product's quality should be consistently met, from one occasion to another. These concerns basically illustrate how important it is to make the product look appealing to customers, i.e. how important it is to communicate with customers and meet their expectations.

As pointed out by Hultink and Robben (1995) new products need to deliver superior value to customers (by scoring high on some critical performance parameters, by having an attractive price-performance ratio, by being reliable). However, more than having the aforementioned properties, they also need to make customers aware of their existence and qualities.

Cooper and Kleinschmidt (1986) provided empirical evidence showing that launch strategies played a significant role in new product development performance, in that they influenced the degree of new product success. Several variables help to understand the impact of launch strategies on new product success, namely those referred by Hultink and Robben (1995): relative innovativeness, order of entry, pricing, promotion decisions, product assortment strategy, and the company's characteristics. As argued by the authors, these variables, shaping launch strategies of the firm, will presumably influence the degree of new product success. However, and despite this theoretical relationship, there is little research on the antecedents and consequences of launch strategies.

To better extract lessons about how the product is being diffused/adopted, it can be advantageous to keep the nucleus of the team together after launch, so that the transitional phase to full production and market launch can be made smoother, as well as to facilitate collective learning that can be later disseminated throughout the organization when the team gets dispersed. This learning can subsequently be incorporated in future product generations (House & Price, 1991). Considering that diffusion theories are theories of communication (Mahajan, Muller & Bass, 1990), and then bi-directional by nature, it seems important to incorporate feedback mechanisms able to bring information about market reaction to the product inside the firm, and to process this information. Such an approach would probably provide the basis for an interactive perspective on the relationships between an organization's launch strategies and market reactions.

2.4.4. Summary: Practical utilization of product innovation models

Empirical research on product innovation consistently demonstrated two things: (1) most companies are making a deficient utilization of new product development models and techniques (Cooper & Kleinschmidt, 1986); and (2) despite increased sophistication in new product development processes, the last 20 years have not witnessed a significant improvement in the percentage of

successful introductions (Wind & Mahajan, 1988). Two reasons may help to explain this state of affairs: (1) the models are not adequate for organizational utilization and thus are rejected by companies; or (2) companies have not sufficient knowledge of the models, and are not extracting all the possible benefits from these tools.

The picture provided by organizational surveys, such as the one conducted by Mahajan and Wind (1992) is somewhat confusing. From 78 questionnaire responses coming from 69 Fortune 500 companies, the authors concluded that companies tend to make little use of available models for product innovation, even though they considered them useful. Firms utilised these models to improve the success rates of new product development and to identify and solve problems related to this process. Two major causes for explaining non-use of product innovation models were forecast inaccuracy, incapability of the models to capture market complexity and long implementation time. Paradoxically, however, respondents considered that the process could be more profitable if a more formal and quantitative approach was adopted. The paradox lies in the fact that companies make claims for the use of more formal and quantitative approaches that tend to be more time-consuming, being an excessive demand of time one of the major shortcomings attributed to the existing processes. To surmount these obstacles as well as the referred incapacity to recognise the complex nature of the business environments, companies may make more use of improvisational models. These approaches, however, are less formal and more intuitive than traditional models and run counter the suggestions advanced by respondents. In sum, Mahajan and Wind's (1992) survey presents a disturbing picture, in which mutually inconsistent propositions are made to solve organizational problems.

To close the gap between product innovation models and actual organizational practices, researchers need to address not the question of what organizations should do, but of what they can actually do. In other words, a fruitful research avenue will appear in the day researchers make the assumption that their models are hard to apply as a departing point, instead of insisting that their prescriptions are the best way for developing new products. The pros and cons of model modification, the conditions that stimulate the skipping of phases, and the contingencies that recommend specific modifications of the basic template, are some of the questions that should be addressed in order to handle and overcome the inconsistencies and weaknesses uncovered by surveys such as the one conducted by Mahajan and Wind (1992).

2.5. PRODUCT INNOVATION RESEARCH: WHERE DO WE GO FROM HERE ?

To conclude this chapter, two goals will be pursued: (1) to provide a global, integrative perspective of product innovation research; and (2) to show how such an integration points out possible future research developments in this field. To do so, three main approaches to product development will be introduced. They

represent different but complementary ways of approaching new product development: (1) a contingency approach to product innovation; (2) a configurational approach to product innovation; and (3) a longitudinal approach to product innovation.

2.5.1. A contingency approach to product innovation

An in-depth study of 16 product innovations in four companies, involving some 80 interviews with people that had participated in the innovation process, showed (Dougherty, 1995) that simple and rigid rules of thumb have worked well for stable environments but that their reification, coupled with the changes occurring in the company's markets, turned previous core competencies into current core incompetencies. These conclusions, highlighting the context-dependent nature of product innovation, seem to support the need for developing a contingency framework for the study of product innovation.

The literature on new product development is acknowledging the need for developing contingency models. This need is spread throughout innovation literature, as can be seen in the following illustrations: (1) differences between high-tech and consumer goods industries influence the role of marketing in the new product development process (Workman, 1993); (2) each 'process segment', or the specific part of a firm involved in the production of a certain product (Abernathy & Utterback, 1978), may require an appropriate design, depending on the product's life cycle stage; (3) innovation development in highly institutionalised contexts can be explained by deterministic models, while in less institutionalised environments, emergent processes seem to better describe innovation patterns (Poole & Van de Ven, 1989); (4) improvisational models of product innovation are probably less useful in the case of incremental innovation, where the need to break standard operating procedures is felt with less intensity; and (5) the suitability of adopting the virtual, networked organizational format, depends on the nature of the new product to be developed, with autonomous innovations recommending virtual forms, and systemic innovations claiming for more integrated and centralised approaches (Chesbrough & Teece, 1996).

Additional research is also contributing to expose the need for contingency approaches to product innovation. As pointed out by Wind and Mahajan (1988), the magnitude of the product life cycle may affect the kind of new product development process that is available for adoption. As remarked by the authors, products with long life cycles may need to be compressed. If a company tries to apply the same kind of process to every product, it risks to miss or to sink the boat (Dickson & Gigleriano, 1986), depending on the circumstances.

One of the studies that illustrates the need for contingency models in new product development has been conducted by Olson, Walker & Ruekert (1995). The analysis of 45 new products developed in 15 divisions from 12 firms, showed that more participative structures of new product development (e.g. matrix structures,

design centres) were more appropriate, because they significantly improved effectiveness and timeliness when the products to be developed were very innovative. When, on the contrary, the degree of product innovativeness was low (e.g. product improvements, line extensions), less participative mechanisms were more effective (bureaucratic control, individual liaisons). A possible explanation for understanding Olson et al.'s results, is that highly participative structures are usually more time consuming and call for more intense integration efforts. These costs may be to high to apply for simple and straightforward innovations.

As all the previous examples illustrate, research on new product development should avoid the search for universal models if it intends to create more valid and useful theories of product innovation. The remarkable example provided by Donaldson (1985; discussed under section 2.2.2.2.2.1.) about the relationship between product life cycle and organizational design, has only been possible because of the accumulation of empirical research within the contingency framework. Cumulative efforts are fundamental for scientific progress because they simultaneously provide multiple perspectives about a single phenomenon, allow the emergence of specificities, and make it possible to confront and solve theoretical inconsistencies. Research cumulativeness on contingency theory underlined the usefulness of a contingency framework for studying new product innovation.

2.5.2. A configurational approach to product innovation

As pointed out by Dougherty and Hardy (1995), organizational components are not independent parts. Rather, they are parts of an organizational system composed of many, interrelated subparts that reinforce each other in self-correcting, self-sustaining ways. One of the major problems concerning product innovation research is precisely the lack of such a systemic, configurational perspective.

The need for configurational approaches has been noted by several scholars and popular business authors. Peters and Waterman (1982) and Treacy and Wiersema (1993), for example, have clearly suggested the need to adopt configurational approaches to design and management, be this through a central set of shared values or through staying focused on a single value discipline. This holistic, configurational thinking, however, is taking time to penetrate product innovation research.

Nevertheless, such a perspective may be of fundamental importance, considering that product innovation influences and is influenced by other organizational processes. Research evidence collected by Pisano and Wheelwright (1995) pointed out the need to articulate product and process innovation as two interdependent parts, or sub-processes, of the whole organizational process: concurrent development of new products and technologies to manufacture these

products are both necessary, even if manufacturing is often perceived as a marginally relevant element for a company's success.

The authors that have most notably referred to the need for configurational approaches to product innovation are Miller and Friesen, who wrote: 'We believe that in research on product innovation, many of the conflicts in the literature have been caused by the failure of researchers to take into account the nature of the configuration of the firm and the strategy or philosophy behind innovation' (1984: 155).

The recognition of the systemic nature of organizations, could be expected to stimulate research on the imperatives and correlates of organizational configurations, defined by Miller as 'alignments among strategy, structure, and environment' (1990: 771). The concept of configuration has, at least a major implication in the study of product innovation: it suggests that organizational parts have interdependent, robust, reciprocal, relationships between each other, being therefore difficult to introduce significant realignments in one element without introducing corresponding corrections in the others.

2.5.3. A longitudinal approach to product innovation

One of the problems with research on product innovation, concerns the cross-sectional nature of most investigation. This means that research frequently focuses the level of single products, and therefore the management of product portfolios is an almost ignored issue. Yet, more important than having a successful product, is creating a complete and vibrant portfolio of products.

The creation and management of product portfolios has been addressed by Brown and Eisenhardt (1995b). In this sub-section, the concept of multiple horizon organization will be presented, and showed how it opens new ways of thinking about and managing in time. Previous attempts have been made to strategically integrate all the information concerning new products. The product innovation charter (Crawford, 1980) is such an example. The problem with the charter was related to its excessive reliance on formality and rationality and to its static nature. Although developed to promote integration of innovation, the charter may potentially act as an instrument of control and a facilitator of rigidity.

The concern for dynamically managing in time seems to be arising as a fundamental topic in organization and marketing studies, as demonstrated, for example, by current concerns with theories of timing (Albert, 1995), windows of opportunity (Tyre & Orlikowksi, 1994) or competitor response time (Bowman & Gatignon, 1995), and it seems to be particularly relevant in a period during which most firms are facing problems of profitability due to the high costs of simultaneously developing and launching new products (Nobeoka, 1995). Bouwen and Fry (1988), for example, included the need for articulating three behavioural aspects (maintaining continuity, introducing novelty, and

accomplishing transition) in a research agenda for organizational innovation in the 1990s. Brown and Eisenhardt's (1995b) research constituted the first empirical effort articulating the three levels considered by Bouwen and Fry.

In an exploratory, qualitative study involving six U.S., two European and one Asian firm in the computer industry, Brown and Eisenhardt (1995b) found that firms with less product portfolio pathologies (e.g. failure to meet schedules, missed windows of opportunity, mistargetted products) were those more able to manage in time: they improvise in the present, experiment with the future, and develop highly structured transitions between the present and the future. On the contrary, firms with numerous product pathologies were unable to manage in time: their managers misstructured the present, fixated on a single future, and did not connect present and future time horizons. These findings led the authors to coin the 'multiple horizon' concept, which is supposed to increase our comprehension about the importance of time for the management of product portfolios.

As predicted by the emergent school of organizational thought (Weick, 1995), Brown and Eisenhardt (1995b) observed that in the successful firms, a clear combination of structure and improvisation coexisted. The study also highlighted the relevance of real-time information for successfully managing product innovation (Moorman & Miner, 1995), and confirmed the pertinence of some assumptions arising from the science of complexity, namely that innovative organizations are those standing on the edge between order and chaos (Stacey, 1993). The importance of these apparent contradictions for the success of product innovation, has also been captured by Jelinek and Schoonhoven (1990), who see innovating firms as operating 'in an ongoing tension between stability and change, past commitments and future opportunities, freedom and direction' (p.7).

As the previous description suggested, the empirical research conducted by Brown and Eisenhardt (1995b) is a stimulating one, in the sense it provides empirical support for some variables emerging as powerful concepts for building a dynamic perspective of product innovation. That is the case of concepts like structured transitions, real-time information, minimal structures, improvisation, experimentation, small losses, and sensemaking. By arguing in favour of the importance of articulating several theoretical domains (resource-based view of the firm, complexity, emergent perspectives, and strategic management) for the study of product innovation, Brown and Eisenhardt's research points out the importance of overcoming the dominant normative and highly a-theoretical perspective on the study of product innovation.

2.6. FINAL COMMENTS

In his essay about technology strategy, Adler (1989: 80) referred that 'the study of technology strategy is not a discipline with a well-developed internal motor of conceptual development. On the contrary, research in this field necessarily trails

behind practice'. The same could generally be said about product innovation research. It is necessary to highlight that there has been huge progress in the field, not only in terms of the volume of investigation, but also in terms of theoretical and methodological sophistication.

Needs for future research should then try to integrate existing bodies of theoretical and empirical research in more integrative conceptual frameworks. These integrative perspectives could be expected to refine concepts, to test and increase the validity of existing models, to define the conditions under which a given model may be expected to hold predictive and explanatory power, and to facilitate cumulativeness of findings.

3. An Organizational Model of Product Innovation Performance

3.1. PRODUCT INNOVATIVENESS AS AN ORGANIZATIONAL PROPERTY

As pointed out by Ruekert, Walker, and Roering (1985), organization issues are seldom addressed in the marketing literature. However, they can bring interesting insights to the comprehension and practice of marketing management. As argued by Tushman and Anderson (1996), the management of innovation is an organizational problem. It can then be approached from an organizational perspective, a perspective able to integrate the stream of decisions and events that take place while organizations act as agents of innovation.

This work analyses product innovation from a point of view that blends contributions from organization science and marketing. It integrates organizational factors, technology, the firm's orientation, product innovation operations, product innovation outcomes, and product innovation performance into a single comprehensive model, taking product innovativeness as an organizational property. The basic assumption underlying this chapter is that marketing activities are sensible to the corporate contexts where they do occur.

Three recent multisite, in-depth research projects, conducted by Clark and Fujimoto (1991), Jelinek and Schoonhoven (1993), and Tushman and O'Reilly (1997) make compatible claims for the need to integrate a multitude of organizational factors, when the goal is to organize for keeping innovation active time and again. The major conclusions of these projects (summarised in Table 3.1) run in the same direction, making visible the situated nature of product innovation and inviting other researchers to treat innovativeness as an organizational property. As argued in Chapter 2 and revealed by empirical data (e.g. Deshpandé, 1982) and in-depth reports of product innovation, this may be a valid departing assumption.

Table 3.1.
Product innovation as an organizational problem: Some questions and answers

Authors	Central question	Major finding
Clark and Fujimoto (1991)	What are the sources of superior product innovation performance ?	The centrality of an overall pattern of consistency in the total development system, including organizational structure, technical skills, problem-solving processes, culture, and strategy. This consistency refers both to the general architecture of the system and to working-level details
Jelinek and Schoonhoven (1993)	How to create continuous streams of innovation that succeed commercially over time ?	Innovation efforts resemble a marathon: a long and hard contest of endurance, supported by the coordinated efforts of many people in the long run
Tushman and O'Reilly (1997)	How to manage for today's requirements and for tomorrow's possibilities ?	The need to combine evolutionary and revolutionary innovation through the management of vision, strategy, culture, politics and technology

Chapter 3 is organized as follows: section 3.2 discusses the organizationally situated nature of product innovation, and section 3.3 presents an organizational model of product innovation performance. The presentation of the conceptual model in section 3.3 starts with the exogenous constructs, moves to the endogenous constructs, and finally to the justification of the proposed relationships between the constructs.

3.2. THE SITUATED NATURE OF PRODUCT INNOVATION

In this chapter, some of the ways by which the organizational context influences the practice and outcomes of product innovation will be presented and integrated into a model of product innovation performance. The assumption underlying such a model is that it is not possible to fully assess the roots of product innovation performance unless product innovation activities are studied within the contexts where they occur. Before entering the discussion of how the organizational context shapes innovation, it is important to make explicit what is meant by organizational context. According to Kimberly (1986), there are, at least, five different ways of conceptualising the problem of the organizational context in the study of innovation: (1) the organization as user of innovation, (2) the organization as inventor of innovation, (3) the organization as inventor and user of innovation, (4) the organization as vehicle for innovation, and (5) the organization as innovation.

Each of these five types of conceptualisation, provides a different approach to the management of innovation and helps to explain why it seems so hard to develop a general theory of organizational innovation. This work will be essentially built

around the perspective provided by Type 2, which means that the organization will be viewed as an inventor of innovation or, to be more correct, as a producer of innovation, considering that invention means the very first creation of something new.

As meso and interactional perspectives of organizations suggest, an accurate understanding of organizational functioning is dependent on the degree to which processes and contexts are articulated, and levels of analysis connected (Schneider, 1983; Cappelli & Scherer, 1991). Several investigations in different fields of research have considered the importance of the context in shaping organizational action, including product innovation (Dougherty, 1996).

Empirical research on product innovation should then be developed, focusing on the articulation between individual, group, organizational and interorganizational levels, and aiming to show how the interactions between phenomena at different levels of analysis facilitates or constrains the development of innovations and, particularly, the development of new products. This work aims to be a step in that direction, by integrating market, organizational and operational constructs within a single model.

The claim for product innovation to be viewed as a process-dependent activity rests on two major remarks (Tornatzky et al., 1983): (1) new products are developed inside organizations, thus being dependent on intraorganizational dynamics; but, (2) as argued in Chapter 2, most of the product innovation literature approaches the theme from a macro (national system) or a micro (project) level perspective, without articulating the organizational dynamics with the product innovation process. Table 3.2. provides a non-exhaustive summary of the research on organizational factors as determinants of product and process innovation.

Table 3.2.
Organizational determinants of innovation: A literature sample

Authors	*Determinants*
Baldrige & Burnham (1975)	Organizational size, organization complexity
Tornatzky & Klein (1982)	Compatibility, relative advantage, complexity
Lilien & Yoon (1989)	Strategy, organization, R&D, production
King (1990)	Organizational size, structure, resources, knowledge of innovations, age, strategy, organizational climate, culture
Nystrom (1990)	Strategy, structure, culture, climate, leadership
Damanpour (1991)	Specialisation, functional differentiation, professionalism, managerial attitude toward change, technical knowledge, administrative intensity, slack resources, external and internal communication
Capon et al. (1990)	Market characteristics, R&D, organizational structure, organizational climate

As the variety of organizational influences presented in Table 3.2. suggests, managing product innovation is much more than managing projects: projects are often perceived as 'figures' that too commonly deviate attention from the organizational 'ground'. As a complement for focusing individual projects, research should also focus the organizational contexts where these projects take place. The importance of contexts for innovation is captured by Dougherty and Hardy (1995: 12), when they state that 'managers can create an organizational system that supports and nurtures product innovation. Resources, processes and meanings reinforce each other in self-sustaining, self-correcting ways'. As this statement suggests, some organizational contexts are more able to support innovation than others, which directs the analysis from the project to the organization.

Despite the previous observations, comprehensive studies directly investigating the effects of organizational characteristics on product innovation in organizations, are much rarer than could be expected.

Although some factors that might affect the development of product innovations are external to organizations, relating to market conditions, technology development, and government regulations, other factors however, as shown among others by Clark and Fujimoto (1991), are internal to the company and therefore manageable, including strategy, structure and technology. Despite the fact that innovation researchers have investigated which organizational characteristics may have significant consequences for the development of new products, research testing organizationally comprehensive models of product innovation, is almost non-existent.

In this study, product innovation practices and outcomes are viewed as shaped by organizational characteristics. An organizational perspective will be used to develop a model focusing on what characteristics of the organizational context are more likely to impact product innovation performance. This perspective assumes that firms can adopt and implement several management choices which, in turn, may facilitate or harm the organizational capacity to develop new products.

The perspective to be developed here is diverse from the approach that most research studies adopt for studying product innovation. Usually, research on the topic takes an organizationally limited stance on the factors shaping the product development process. The well-known studies of Cooper (e.g. 1993), for example, are developed as universal approaches for effectively conducting product innovation. These studies are not very sensitive to the constraints and opportunities introduced by the organizational and market contexts where product innovations bloom. Studies on the marketing/R&D interface may also be said to adopt a segmented perspective, given that interface problems may have a wider structural origin, thus not being circumscribed to these specific departments.

Problems may be related, for example, to the general structural design of the organization, and to the communication channels that it formally imposes on interdepartmental communication, including but not being limited to, the communications between the marketing and R&D departments.

Having fleshed the argument of why product innovation can be viewed as an organizational problem, the discussion will now proceed with the presentation of the building blocks of an organizational model of product innovation performance. Section 3.3. presents the model constructs as well as the relationships between them. The constructs subsections will be arranged according to a division between exogenous constructs (presented in section 3.3.1.) and endogenous constructs (section 3.3.2.).

3.3. AN ORGANIZATIONAL MODEL OF PRODUCT INNOVATION PERFORMANCE

In this section, several organizational constructs expected to influence product innovation will be theoretically analysed. A focused literature review will be conducted and a research model derived. The organizing framework for the review as well as for the model construction will be grounded on the idea that three major organizational determinants of product innovation can be identified: organization, technology and orientation.

3.3.1. The exogenous constructs

Exogenous constructs are those constructs that, in a given model, are not explained by any other constructs in the model. They can be viewed as independent variables. Three exogenous constructs are: organization, technology, and orientation. These constructs, taken together, include a broad range of both stable and dynamic organizational characteristics.

3.3.1.1. Organization

The organization construct refers to those organizational characteristics that, due to their entrenched nature, are not easy to modify, and may be expected to have significant impacts on the organizational capacity to innovate. Size and age, with their direct and indirect effects on product innovation (expressed for example in the structural adjustments inherent to organizational ageing and growing; e.g. Moch & Morse, 1977) are two characteristics that may adequately capture the impact of organization factors on innovation.

In line with the postulates of organizational ecology (Baum, 1996), organizations are considered to suffer from the liabilities of newness and smallness. Considering their importance, we will now address the possible effects of these liabilities over product innovation.

According to the liability of smallness hypothesis, large organizations may constitute fertile grounds for conducting product innovations, due to their higher capacity to sustain development processes that become more and more expensive as competition gets more fierce. Building on the ecological perspective and complementing it with some conclusions arising from the fields of marketing and management, several advantages may be attributed to large organizations, if compared with their smaller competitors: (1) due to the resource acquisition advantages that large firms seem to grant if compared with small, less powerful companies (as argued by Baum, 1996, size can be interpreted by stakeholders as a measure of past success and future dependability), large organizations may have access to more and better resources and technologies; (2) larger firms may have more slack which, to a certain extent, facilitates organizational change and innovation in response to environmental variability (Cyert & March, 1963; Nohria & Gulati, 1996)[1]; (3) large firms with their superior critical mass (Baldrige & Burnham, 1975) are more aware of the opportunities and solutions for innovation arising in their business environments, which may have a positive effect on product innovation (Khan & Manopichetwattana, 1989); (4) large firms seem to be able to develop the capacity to circumvent the potential obstacles to innovation that come with maturity (Dougherty & Hardy, 1996); (5) large organizations, as said by institutional theory, often adopt and legitimise innovations that are subsequently adopted by smaller organizations, which means that smaller organizations frequently imitate the behaviours of large firms and not the other way around; (6) several features of large organizations, including internal complexity, differentiation, and specialisation, have been found (Haveman 1993) to be associated with the adoption of innovations, a finding that may be interpreted as showing the porosity of large organizations to externally induced innovations.

Additionally, a meta-analytic study conducted by Damanpour (1992), showed that there is a positive relationship between size and innovation. Kimberly and Evanisko (1981) found that an organization's size works as the best predictor of the adoption of both technological and administrative innovations. Mohr (1969) reached a similar conclusion. In order to explain these results, the findings of a research conducted by Schoonhoven and Jelinek (1990) should be taken into account. According to the authors, size may not a problem itself, as companies often need to grow if they intend not to be removed from the population to which they belong. The problem with size seems to lie in the fact that it imposes new and complex demands in terms of structural design. However, if the challenges of structural design are properly handled, large organizations, being less vulnerable

[1] There seems to exist an inverse U-shaped relationship between slack and innovation: too much slack may diminish discipline towards innovative projects; too little slack diminishes the willingness to experiment and to engage in innovation (Nohria & Gulati, 1996).

to external threats than their smaller counterparts, may take significant advantages from size in terms of, among other things, innovative capacity[2].

The effects of the liability of newness are also well documented in the organizational literature and particularly in the ecological and institutional schools of thought. As stated by Hannan and Freeman (1989), organizations tend to develop routines that favour the emergence of high levels of structural inertia. In a superficial approach, these routines, may seem to harm innovation, since innovation is, by definition, a depart from routine. Such concern is reflected in the Pierce and Delbecq (1977) hypothesis that as organizations grow older, they become more bureaucratic and less receptive to innovation. Kimberly and Evanisko (1981), however, obtained empirical evidence that led to the conclusion that the adoption of innovations by older organizations may work as a means for ensuring the company's position in its industry.

A richer understanding of the relationship between age and product innovation should take other less immediate factors into account. Organizations need both routine and innovation: routine leads to efficiency, innovation leads to effectiveness (Fonseca, 1995). Hence, a mix of organic and mechanistic structuring seems to be necessary to balance the organizational needs for efficiency and effectiveness (see also Brown & Eisenhardt, 1997). Consequently, organizations combining the advantages of being older and 'wiser' (Baum, 1996), i.e. of balancing established and efficient routines, with the capacity to learn from the marketplace, may be in a position of competitive advantage. The strengths of hybrid forms of structuring, mixing organic and mechanistic characteristics, have been empirically documented by Khandwalla (1987) and Eisenhardt and her associates (Eisenhardt & Tabrizi, 1995; Brown & Eisenhardt, 1997).

As an alternative explanation, it can be argued that large corporations may succeed as learning organizations (Kogut, 1993). Although not necessarily being pioneering innovators in the adoption or development of new products or processes, large companies may show striking capabilities for imitating innovative organizations from the very start of the diffusion process. In the case of large and old organizations with favourable positions in an information set, these organizational characteristics may not harm their capacity to develop and launch product innovations. In the case of these companies, the creation of imitative channels, fuelled by contacts with customers or technology suppliers (Von Hippel, 1986) and the participation in social networks that facilitate communication (Rogers, 1983), may help to counter the commonly referred

[2] In this work, 'innovative capacity' refers to the absolute capacity of the firm in terms of product innovation. This concept should be distinguished from the concept of relative capacity, that sometimes is used in alternative to absolute capacity, and that refers to some ratio between an output measure (e.g. number of new products) and an input measure (e.g. number of employees). In this work the absolute capacity of the firm is used, instead of relative capacity, as the total capacity of the firm to influence its market by means of launching new products.

disadvantages of inertial pressures arising with age and size. In the case of well established, mature industries, size and age may turn to be sources of competitive advantage if capabilities for learning and creative imitation are preserved. The dual core approach or any other similar organizing principle (Daft, 1978), keeping innovation centres separated from the pressure of daily routines, may help companies circumventing the so-called bureaucratic syndrome (Dougherty & Corse, 1995), and thus help to understand the existence of the previously referred liabilities of size and age.

3.3.1.2. Technology

In a broad sense, technology may be defined as a means for achieving some desired outcome (Hatch, 1997). In that sense, it has to do not only with the tools or equipment needed for the production of the outcome, but also with the activities associated with methods of production, and the skills necessary to use such tools or equipment.

In a sense, the discipline of product innovation lies in the intersection between strategic management and technology management, with strategy establishing the external positioning of an organization, and the technological dimension defining the range of opportunities that the firm is able to identify and attack. Some authors are consequently claiming that the integration between strategic management and technology management constitutes a priority when the goal is the understanding of product innovation. Among others, Doz (1996) pointed out the importance of the interaction between market learning and technology learning for the success of product innovation, and Adler (1986) showed how market pressures may force the adoption of new technologies and a corresponding development of the new skills required to operate the adopted technologies. This process acts as a leverage for organizational learning and product innovation.

The research programme conducted by Nystrom (e.g. Nystrom & Edvardsson, 1982) displayed consistent findings on the relationship between technology and marketing. These findings have been subsequently corroborated, for example, by Cooper (1993). These authors' results show that high performance in product innovation requires a blend of technological prowess and market orientation. Such a conclusion, signalled the need to melt technology-led and marketing-led innovations, instead of favouring one approach over the other (Johne & Snelson, 1988). Organizations following a balanced-focused strategy (see section 2.2.2.2.1.1.), characterised by an equilibrium between technological and market concerns, were found to be the best performing of all strategic types.

By putting state of the art technologies into use, firms may simultaneously profit from the possibilities of launching technology-pushed products and of developing their employees' skills. Other advantages arising from technology are related to: faster development time, an increasing scope of available market opportunities,

and the possibility of incorporating the technological superiority of the firm into its product development operations. For all these reasons, technologically-leading firms may have access to opportunities for product innovation that may not be attainable by their less sophisticated competitors (Khandwalla, 1987).

3.3.1.3. Orientation

Organizational orientation, defined as the way an organization approaches and manages its external environment, may constitute an important influence of product innovation. An organization's orientation is reflected in factors like the strategy the organization formulates and its degree of market orientation. Research on the fields of strategic management and marketing led to the conclusion that a firm's orientation impacts its innovative results (Miles & Snow, 1978; Jaworski & Kohli, 1993).

The influence of strategic positioning on product innovation has been pointed out by several authors. Drew (1992a), for example, viewed strategy as a means for articulating the organization with its environment, and product innovation as an instrument for achieving this articulation. A proactive strategy, supported by a strong market orientation, facilitates market knowledge, thus making it easier to formulate and implement more innovative strategies. Consistently, the importance of an organization's orientation has been acknowledged by Bentley (1990), who showed that proximity to the market is a strong determinant of new product success.

Although claims for the suitability of different strategic types have been made, proactive, market-oriented firms seem to be better positioned to obtain superior results in terms of product innovation (Miles & Snow, 1978; Khan & Manopichetwattana, 1989) and sustainable competitive advantage (Lengnick-Hall, 1992), because they accurately reflect market realities and more aptly respond to customer demands. Organizations that exhibit such qualities as pro-action and proximity to the customer, may have the means to learn better and faster than competitors, and therefore the possibility to translate such learning advantages into new and better products from the customer point of view. This may happen because such firms are closer to the most relevant sources of learning: customers and competitors (Slater & Narver, 1995). Customers may act as levers for learning. Their explicit needs exert a demand pull effect that pressures the firm toward innovation; through their inarticulate needs, they act as sources of ideas for yet to come products, products whose necessity can be only vaguely expressed.

Another possible advantage arising from pro-action, is the favouring of large product assortments. As referred by Hultink and Robben (1995), large and differentiated product assortment strategies, may constitute a way for increasing the firm's market space, an important goal for proactive organizations (Miles & Snow, 1978).

The Miles and Snow (1978) typology provides a comprehensive explanation for the reason why companies with a proactive positioning (called prospectors in their typology) may take several advantages, in terms of innovation, from their willingness to seek out new opportunities and explore them before competitors. Compared with other strategic types, prospectors proved to be more innovative than defenders, analysers and reactors. The proactive nature of prospectors, coupled with their superior degree of attention to the market, make the need to develop sophisticated product innovation operations more salient. These operations are important for those companies as they increase the possibility of developing new products genuinely tailored to actual customer demands. More and diverse structural arrangements may also be used by these firms, in order to better meet the needs triggered by the features of demanded products.

The process of information acquisition, processing and utilization has been historically addressed by the marketing discipline. This is not surprising, considering that market knowledge, in particular, seems to have several positive impacts on organizational performance (Jaworski & Kohli, 1993). Market knowledge may be defined as the extent to which an organization engages in the gathering of information about its market, including at least information about customers and competitors, and how it assimilates this learning. The concept of market knowledge is normally subsumed by the more broader concept of market orientation. According to Hunt and Morgan (1995), market orientation can be thought of as referring to: (1) the systematic collection of information about actual and potential customers and competitors; (2) the analysis of this information for the purpose of developing market knowledge; and (3) the organizational use of the market knowledge (including, among other things, the development of new products).

Market orientation refers to how much attention an organization pays to its customers and competitors. Taking market knowledge creation as the central feature of the market orientation construct, it is hypothesised that market knowledge may be of instrumental value for helping the organization in the identification of market opportunities and threats, as well as in the development of processes and operations that increase the possibility of translating detected opportunities into successful new products, conceptualised and developed in order to meet these opportunities. According to De Geus (1988) the essence of marketing planning lies precisely in the possibility of learning and rapidly adjusting the organization to market changes. As argued by Dickson (1992), fast market insights give the organization more time to innovate, to imitate, and to avoid crisis management, which may be a precious competitive weapon in markets characterised by intense competition.

A strong market orientation may represent an important source of learning because: (1) it forces the organization to continuously engage in the collection of information about customers and competitors, and (2) this constantly renewed

pool of information may be used to create superior value to the customer (Slater & Narver, 1995).

As shown by the product innovation literature, creative learning may be facilitated by a deeper understanding of customers' needs and problems (Cooper, 1983). By staying in touch with markets, companies may be better able to successfully manage the process of coupling between internal capabilities and user needs (Tushman, 1977). By contrast, companies with less developed market knowledge systems, may not be aware of changing needs, and fail in their efforts to articulate user needs with organizational processes. The exposure to market pressures is a powerful stimulus to keep the renewal process fuelled and active, and to ground new products in market realities (Yang & Dougherty, 1993). Hence, factors like proaction and market knowledge may be thought of as having positive impacts on product innovation performance.

3.3.2. The endogenous constructs

Endogenous constructs are those explained by one or more exogenous variables. To use more current terminology, they may be thought of as dependent variables in a model. In structural equation modeling techniques, they may also act as determinants of other endogenous constructs. The endogenous constructs to be considered in this work are the following: product innovation operations, product innovation outcomes, and product innovation performance.

3.3.2.1. Operations

As shown by an abundant research tradition in the field of product innovation with highly consistent results throughout time and industries (for a review see Craig & Hart, 1992), product innovation operations have a strong impact on the performance of the product innovation function and on the financial results of many companies. The dominant normative literature on product innovation (e.g. Cooper, 1993) suggests that there is a superior template for developing new products. This template consists of an identified series of actions, from ideation to post-implementation review (see section 2.4). According to such literature, companies with product development processes that skip phases, become more vulnerable to failure than those with complete and well implemented processes (Cooper & Kleinschmidt, 1986). The reasons underlying this vulnerability result from the fact that deficient products may be those not submitted to a thorough and precise set of guidelines until completion. As process activities tend to improve the end product by improving the means for developing it, less 'filtered' products, developed by less rigorous companies, tend to have a smaller probability of commercial success.

For analytical clarity, the multiple phases of the new product development process can be grouped in two major blocks: pre-development and development. These two major blocks seem to adequately capture the organizational

competencies necessary for effectively developing new products: during the pre-development or preparatory phase, boundary spanning capacities are tested and organizing competencies addressed; the development phase refers to the firm's capacity to handle the several activities that transform the idea in a new product ready for launch.

According to the empirical results obtained by Cooper (1988a), these early phases, including the designing for innovation and the generation and screening of ideas for product innovations, have a significant impact on the number and newness of a firm's product innovation. In short, pre-development refers to how the organization prepares for product development. As demonstrated by Cooper (1988a), pre-development activities appear to be predictors of new product success. This predictive power, however, was not enough to invite companies to have a careful approach to pre-development activities. The same study showed that in only a quarter of the projects analysed, there was a careful and complete management of pre-development activities.

Development phases, in turn, refer to the actual development process, including the phases of business analysis and market testing. The impact of the development process on product innovation results, is a well known conclusion, consistently reaffirmed by several empirical studies (e.g. Cooper, 1993).

A more detailed and rigorous sequence of phases may be expected to happen in the proactive, customer-oriented firms, given that these firms, due to their characteristics, will tend to develop a more accurate perception of the importance of each phase for ensuring that the final product will be adapted to actual user needs. Such a perception may not be so intense in less proactive and less market-oriented organizations, which may make less utilization of close relationships with users (Von Hippel, 1986) and, hypothetically, do not put so much stress on the necessity of complete and rigorous development operations.

3.3.2.2. Product innovation outcomes

Product innovation is a central concern for contemporary organizations and a crucial activity for the continued success of most firms. As stated by Dougherty (1996), product innovation is important in the sense it enables companies to: (1) improve the quality of their output; (2) revitalise mature businesses; (3) get a position in new markets; (4) react to situations of competitive encroachment; (5) put new technologies into use; and (6) leverage investments in new technologies.

Briefly, a new product can be defined as a product not previously manufactured by a company (Rochford, 1991). More than an isolated organizational process, product innovation is regarded as a central but integrated and contextualized segment of organizational activity. To use Yang and Dougherty's (1993) words, product innovation is more than just making new products. New products were selected as the focal marketing outcome of this study for several reasons: (1)

products are at the heart of organizational existence; (2) product innovation constitutes a critical means for organizational renewal; and (3) product innovation is influenced by a wide range of organizational variables.

The product innovation capacity of a firm, operationalised in the number of new product introductions and the products' newness degree (here taken as the two main product innovation outcomes), may be a central element for assessing a firm's adaptive capacity, especially in turbulent environments with increasingly short product life cycles. Product innovation may consequently, be viewed as an internal throughput-based measure: a measure of how effectively the organization proves to be capable to transform external inputs into outcomes potentially valuable to the market: new products. A high number of new products may serve to signal a distinctive capacity of diagnosing market needs and responding them. It consequently relates the firms' capacity to 'read' the environment with the capacity to make structures and processes work for the fulfilment of customer needs. A high number of new products, however, does not necessarily mean that such products are really innovative. A high number of new products should thus be an highly valued outcome, especially if new products are also highly innovative new products. Product innovations with high levels of newness can be thought of as being of instrumental value for the process of organizational adaptation and renewal.

3.3.2.3. Product innovation performance

Product innovation performance can be defined as the degree to which product innovation outcomes and the company's overall product innovation programme have achieved their goals. Of course, whether products and programme have achieved their goals, depends on management prior expectations.

Two evaluative dimensions can be considered as appropriate for measuring product innovation performance: the individual product success, and the global effectiveness of the total product innovation programme. These dimensions, that are currently used in product innovation research (e.g. Cooper, 1984a), can be considered theoretically relevant as they focus on two important facets of product innovation: on the one hand, the results achieved by individual products (which constitutes a direct measure of the product innovation function); on the other hand, the contribution of this function to the company's goals (which puts the innovation function in the wider context of strategic intention), operationalised in the results of the organization's product innovation programme (Johne, 1996).

Performance is analysed according to two complementary perspectives: a product-focused dimension, where product success is the unit of analysis, and a strategy-focused dimension, where the overall product innovation programme serves as the unit of analysis. It seems important to consider these two dimensions because the success of any individual product may not lead to a successful programme from a corporate wide perspective. The combination of

product success and programme performance seems appropriate, as it acknowledges not only the importance of successful products but also the broader product innovation performance of the firm. The analysis of the individual products and the firm's total product programme may help to overcome the narrow focus on individual products, that represents the most current measure in product innovation research. Considering that even organizations with a poor overall track record of new product success can occasionally develop product successes, the inclusion of programme performance may provide a more reliable indication of the quality of product innovation in the organization.

3.3.3. The relationships

This section describes the relationships between the theoretical constructs presented above[3]. The causality links, intends to describe the way a set of organizational level variables impacts product innovation in organizations. Based on the previous discussion, the direction of the relationships between the theoretical constructs and the organization's product innovation performance may already be stated. Table 3.3 offers a summary set of the relations in the model.

Table 3.3.
Relationships between constructs and product innovation performance

Constructs	Relationship to product innovation performance
Organization	
size	+
age	+
Technology	
technological superiority	+
Orientation	
proactive strategy	+
market orientation	+
Operations	
pre-development	+
development	+
Product innovation	
number of new products	+
newness	+

3.3.3.1. Organization → Product innovation outcomes

Considering the effects of both the liability of newness and the liability of smallness, a positive impact of the organizational factors age and size on product innovation is hypothesised to occur. This relationship is supported, for example, by the previous empirical results of Damanpour (1992) and Kimberly and Evanisko (1981).

[3] The examination of construct validity led to the modification of the dimensionalization of some constructs and thus precluded testing the conceptual model originally proposed. The tested relationships were consequently established after analysis.

The positive impact of routines, more powerful in large and mature firms, over an organization's competitive position – including its capacity to innovate – have been stated, for example, by Dickson (1992). The author discussed how the routinisation of procedures, the gathering of information, knowledge utilization, idea screening, and implementation, worked as a competitive advantage. Benghozi (1990), in a similar vein, showed how large organizations can establish innovation routines. Additionally, large organizations may have more slack, which may facilitate the development of more and newer products.

Although the results on the relationship between size and innovation are mixed throughout the literature, they support the following proposition:

P_1 Organizational factors (size and age) positively and indirectly affect product innovation performance through product innovation outcomes.

As referred, routines tend to be especially strong in large and old organizations. The logical step, then is to expect that product innovation to be favoured by the existence of organizational routines, especially when the advantages of being large combine with high learning skills, namely expressed under the form of external orientation and technological sophistication.

3.3.3.2. Technology → Operations

The marketing literature has yet to integrate the corporate and technological components of organizational strategy (Cooper, 1984). This integration seems to be important, considering that, in most industries, the range of product innovation possibilities available to an organization, depends on the firm's technological competencies.

An aggressive technological orientation may have important impacts on product development operations. Rigorous and faster operations may be implemented if a strong technological base, supported by a proactive approach to the acquisition of new technologies, is in place. As a result, better decision making information about what new products to develop, will become available as well as better tools for turning this information into sophisticated product innovation operations. This causal link illustrates how the organizational capacity for conducting an adequate management of technology is expected to result in superior operations for developing new products. Thus, the following proposition:

P_2 Greater technological sophistication positively and indirectly affects product innovation outcomes and product innovation performance through product development operations.

3.3.3.3. Orientation → Operations

Market orientation is currently referred as a potential source of competitive advantage (Hunt & Morgan, 1995), as it helps the organization in its effort to adjust to the outside environment. Companies able to combine such an external orientation with internal processes and operations that allow a value-creating use of the market information, are said to be in advantage. The capacity to recognise the value of external information, to assimilate it, and to use it as an input for commercial ends, has been labelled by Cohen and Levinthal (1990) as absorptive capacity. A justification for why absorptive capacity may be critical to innovation, can be found in the organizations as sponges metaphor, suggested by Fiol (1996): organizations need to absorb inputs in order to generate outputs.

As shown by Moorman (1995), information utilization processes may be sources of competitive advantage. More specifically, they act as strong predictors of new product performance. Moorman's study, however, also led to the conclusion that information acquisition and processing do not have, per se, a significant impact on new product performance and timeliness. That author's results suggest that the impact of information acquisition on performance may be mediated by utilization processes. The whole process may thus be represented by the following sequence: 'acquisition→ transmission → utilization → new product outcomes' (Moorman, 1995: 329).

Following the previous observations, it is important to analyse how well information-rich companies actually use their market knowledge. In order to improve utilization skills, companies are supposed to develop structural designs and sets of operations that facilitate the transfer of market information to new product development processes.

Proactive, market-oriented organizations, can be expected to formulate and implement more rigorous, and fine-grained operations. Over time, it is expectable that organizational competencies in the management of product innovation are acquired, and that procedural channels that facilitate innovation are developed and used (Miner, Moorman & Bassof, 1996). Consistent with the market-orientation literature:

P_3 Superior market orientation positively and indirectly affects product innovation outcomes and product innovation performance through product innovation operations.

3.3.3.4. Operations→Product innovation outcomes

The number and newness of product innovations may be caused by: (1) the intraorganizational environment, namely the availability of resources that make it possible to sustain, nurture and exploit innovation (as explicited in the organization → product innovation outcomes link); and (2) by the completeness

of the product development process. The impact of product innovation operations on product innovation outcomes and performance is, probably, the most consistent empirical finding in the discipline of product innovation. A significant influence of the operations construct over the product innovation capacity of the firm, can then be hypothesised. Companies with more rigorous operations can be expected to create more and superior products because they have more fine-grained and possibly more routinised practical approaches about how to develop product innovations. A company's proficiency with the development process, may be of high instrumental value for achieving superior product outcomes. Hence:

P_4 Superior product innovation operations lead to more and newer product innovations.

3.3.3.5. Operations→Product innovation performance

The more companies use operations that support deep processing of acquired knowledge, the more able they are to convert such knowledge in superior new product performance. This conclusion is suggested by Moorman's (1995) results, and shows that operations may constitute a relevant causal link between orientation and product innovation outcomes.

The link between an organization's product development operations and its product innovation performance is a well established finding in the new product development literature. This relationship illustrates the fact that fine-grained development processes are more likely to lead to commercial success. As this and the previous causal relations suggest, product innovation operations may have both direct and indirect influences on product innovation outcomes. The direct impact of operations on performance may be due to the fact that better processes are not only instrumental for developing superior products (indirect path) but also constitute perceptual marks of how seriously and effectively the organization is taking product innovation into account. It can thus contribute to a more positive appraisal of the product innovation function. In other words, operations can not only contribute to better product innovation outcomes, but also to a more favourable appreciation of the firms' product innovation performance. This discussion leads to the subsequent conceptual proposition:

P_5 Superior product innovation operations lead to better product innovation performance.

3.3.3.6. Product innovation outcomes→Product innovation performance

In a growing number of industries, superior product innovation can be conceived as synonymous with success (Maidique & Zirger, 1984). Therefore, it is an organizational outcome of growing importance.

The way a firm assesses the performance of its product innovation function is hypothesised to depend on the number of new products launched and their degree of newness. Many new products with a high perceived degree of newness, may lead the organization to characterise its new products and product innovation programme as more successful than if fewer and less innovative new products were developed.

In highly turbulent and competitive environments, proficiency in product innovation may signal a high degree of organizational adaptiveness and capacity of renewal. Considering the product innovativeness impact on financial revenue and differentiation (e.g. Hart, 1995), a broad assortment of new products with a high degree of newness, may constitute an appealing organizational goal. Thus:

P_6 Superior product innovation outcomes lead to better product innovation performance.

3.3.4. Deriving a model

As discussed above, this work explores causality links between characteristics of the organizational context, characteristics of the product development process and product innovation outcomes and performance. The capacity of the outlined model to predict product development performance in ongoing organizations will be tested. The model, as suggested in Chapter 2, adopts a configurational perspective by viewing product innovation as a result of a set of interrelated organizational inputs.

Considering the strategic character of product innovation (Bruce & Biemans, 1995), and the influence of a set of stable organizational factors, the model was built on three exogenous constructs: organization, technology, and orientation. These antecedents are hypothesised to predict product innovation operations, product innovation outcomes, and product innovation performance. Market and technological prowess, combined with the organizational advantages of established, firmly rooted market positions, are hypothesised to lead to competitively alert and agile organizations (Dickson, 1992). The model depicted in Figure 3.1 blends insights from the fields of marketing and organization, and builds on the possible innovative advantages arising from several contextual characteristics, including age, size, proaction and market-orientation. The theoretical justification for such a model comes from fields as diverse as organization theory (e.g. Kelley, 1996), ecological theory (e.g. Hannan & Freeman, 1989), strategic management (e.g. Miles & Snow, 1978), product innovation (e.g. Dougherty, 1996), and marketing management (e.g. Narver & Slater, 1990).

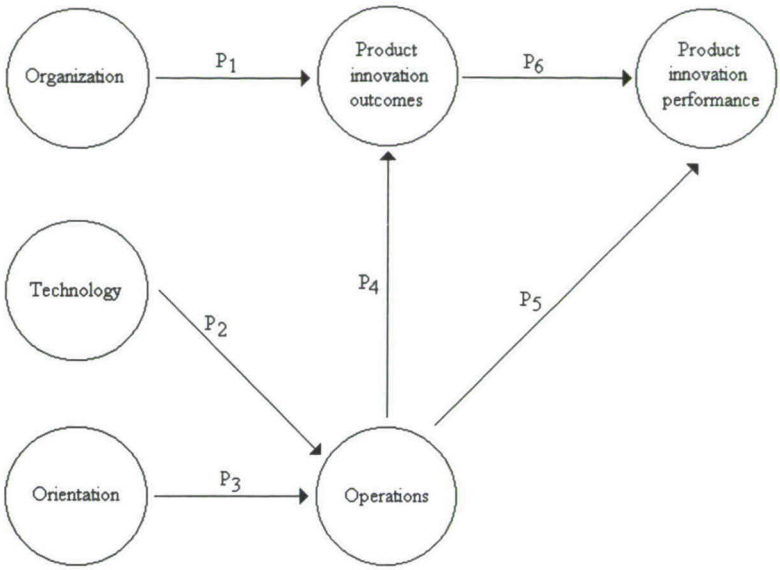

Figure 3.1
The organizational context of product innovation: Conceptual propositions

According to the theoretical rationale underlying this research, differences in product innovation performance should not be exclusively attributed to the higher or lower degree of sophistication of processes used for developing new products. Processes-in-use are a necessary but not a sufficient condition to superior product innovation performance. Other elements include the strategic goals that guide the development process, as well as the organizational context where this process occurs and the sources of technology employed by the company. The model to be tested is a comprehensive one, including variables from different levels of analysis, namely the strategic, structural, and operational levels. However this is not an exhaustive study, meant to include every important factor for understanding product innovation in the context of organizational functioning. In fact, other presumably important variables have not been analysed, like risk taking, reward systems and integration, to name just a few (Saleh & Wang, 1993, Parthasarthy, Yin & Schroeder, 1996).

As discussed, the basic assumption underlying the model, is that a strong external orientation, coupled with an aggressive technological orientation are characteristics that have a positive impact on the competitive success and adaptation of organizations, namely by influencing the success of product innovation efforts. This model of product innovation performance intends to shed some light on the determinants of product innovation in organizations. The identification of the determinants of superior product innovation performance is a relevant research effort, considering that, despite the voluminous literature on the

topic, difficulties with how to succeed in product innovation persist (Cooper, 1993; Dougherty & Heller, 1994). The model as a whole, collects information about the central processes involved in product innovation, namely the context for product innovation, the product development process, the integration between marketing and technology, the conversion of external information into internal operations, and how all these factors impact the firm's product innovative performance.

4. Methods

4.1. RESEARCH PROBLEM

The innovation literature is pervaded by controversy and conflicting results. Downs and Mohr (1976: 700) describe the situation in the following terms: 'Perhaps the most alarming characteristic of the body of empirical study of innovation is the extreme variance among its findings, what we call instability. Factors found to be important for innovation in one study are found to be considerably less important, not important at all, or even inversely important in another study'.

This observation is in line with the arguments of Miller and Friesen (1984) and Brown and Karagozoglu (1989). The lack of stability of research results on product innovation may be due, at least partially, to the fragmented nature of most research on the subject. Examining the pertinent variables in isolation from the larger system of which they are a part, will hardly make the relationships between them comprehensible. One of the things that seems to be missing is the articulation between organizational context and innovative activity. Admitting that the context is a powerful determinant of organizational innovative behaviour, it may not be possible to understand the latter without knowing the former. Empirical results by Capon et al. (1992) support the contention that a holistic, integrative view of the organization is a necessary condition for the comprehensive study of product innovation. In this work it is examined the strategic product innovation behaviour of firms in a sector that is undergoing rapid environmental change, the Portuguese financial sector, and the way organizational factors shape the innovative conduct of firms.

The remaining of this work will be oriented towards testing and discussing the organizational model of product innovation performance presented and discussed in Chapter 3. According to such a model, organization, technology, and orientation constructs are expected to have a significant impact on new product development operations, outcomes, and performance.

Chapter 4 will be organized as follows: section 4.1 presents the research universe for this study; section 4.2 presents the research sample; section 4.3 provides a general overview of the study, including the research plan, steps in developing and refining the research instrument, and the data collection process; section 4.4 provides a detailed presentation of the research instrument; section 4.5 proceeds with the operationalization of variables; and section 4.6 provides a description of the preliminary analysis.

4.2. THE RESEARCH UNIVERSE: THE PORTUGUESE FINANCIAL SECTOR

Before describing the instruments used for data collection, a brief overview of the competitive characteristics of Portuguese banking and insurance will be presented. These descriptions intend to make explicit the reasons that have led to the selection of banking and insurance, instead of other industries as the research universe. The main reason for the selection of the financial industry is the fact that the financial system presents some similarities with the environments that Eisenhardt (1989) described as high-velocity environments, where 'changes in demand, competition and technology are so rapid and discontinuous that information is often inaccurate, unavailable or obsolete' (p. 544). The importance of innovation in high-velocity environments has been well captured by the words of one of the executives participating in Eisenhardt's study in the computer industry, 'If you don't innovate, someone else will' (p.570).

4.2.1. The Portuguese banking system

The Portuguese banking system experienced some major changes during the last twenty years. These changes are not typical or exclusive of this country, but are paralleled by increased intensity of financial services competition all over the world (e.g. Rogers & Miglani, 1988; Heffernan, 1993). Changes in this sector have turned markets from relatively stable to uncertain and highly turbulent environments.

Banks are under the effect of what Freeman (1991) characterised as a change on the techno-economic paradigm, with the old-fordist paradigm being substituted by a new information and communication technologies (ICT) paradigm. Under the new paradigm, standardised and centralised outputs and procedures, are being replaced by rapid changes in product mix and distributed intelligence. This paradigmatic change is revolutionising organizational processes, as organizations try to adapt to the new techno-economic order.

Given the nature of their work, banks are reshaping in order to adapt to a task environment that is especially sensitive to innovations on ICT. Nevertheless, it is important to recognise that, at least, another factor is contributing to dramatic changes: deregulation. Deregulation had the following consequences: (1) entry of new, private-owned, national and foreign banks; (2) privatisation of a significant number of organizations; (3) emergence of new areas of activity; and (4) intra and inter-industry competition.

Because of these important changes in the competitive environment, Portuguese banks have felt that the market was no longer placid as it used to be when most banks were state-owned, and competition not really fierce. Under the emerging environmental conditions, resources became increasingly scarce for the growing number of competitors trying to allocate them.

Resource scarcity stimulated organizations to actively search for more refined competitive strategies and new market domains. As a consequence, borderlines between traditionally separated financial areas (banks, trust, and insurance companies), blurred and became increasingly difficult to draw, while new areas of activity conquered specific market segments (leasing, factoring). The high levels of change and uncertainty turned the banking system into a 'real laboratory' for the study of innovation processes (Metzger, 1989). In particular, research on product innovation seems to be very intense in the financial services sector (e.g. Bowers, 1986; Storey & Easingwood, 1993). Despite this encouraging scenario, it is possible that new product development in the banking industry is now at an early stage of development and refinement. As stated by Grden-Ellson (1986), product innovation in banking often means copying and reformulating existing products or using deficient product development procedures. This is consistent with Bower's (1986) and Edgett's (1992) results, which illustrate the deficiencies of most processes used for developing new banking products.

The banking sector in Portugal is composed by thirty five organizations, and it employed 60 772 people at the end of 1992 (CSFB, 1993).

During the last twenty years Portuguese banking passed through three different phases[1]: an administrative control phase, a transition phase and a competitive phase. The first phase was triggered by the nationalisation of banks in 1975, following the 1974 coup d'êtat. During this phase, some banks were merged, and market rules were substituted by the control of the central bank.

This state of affairs started to change in the beginning of the 1980s, when politicians firstly discussed the opening of banking to private initiative. However, due to the lack of agreement between PS and PSD (socialist and social democrat parties, the two main political forces), privates did not have immediate access to banking. The administrative control phase peaked in the periods of bankruptcy of 1977-79 and 1982-85. During these periods, rigid monetary politics have been followed in order to restore economic equilibrium.

The situation started to change in 1984, when the government decided to create legislation in order to authorise private banking. The entrance of banks like Banco Comercial Português, Banco Português de Investimento, and Banco de Comércio e Indústria, constituted a destabilising event to an industry that used to be relatively placid. Particularly important has been the role of the Banco Comercial Português (BCP), which invested a billion Escudos in information and communication technologies. This amount must be contextualized: at that moment, more than 90% of banking operations were executed without computers.

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[1]The description of the Portuguese banking system is based on Lourenço (1995).

Its investment, allowed BCP to achieve a significant competitive advantage, supported by high levels of efficiency.

The aggressive strategy of Banco Comercial Português forced other banks to react. The increased competitiveness propelled the profits and market-share of private banks, and proved to be damaging to public banks, which were not able to respond to the levels of efficiency and service quality provided by private banks. Public banks struggled, at the time, with two important problems: excess of personnel, and sub-capitalisation. Excess of personnel was caused, in most of the cases, by the absorption of personnel returning from the former colonies in Africa (mainly from Angola and Mozambique). The situation of sub-capitalisation put some banks close to bankruptcy.

The banking industry became much more competitive than in previous years, but there was a factor limiting the action of banks: credit limits. Credit limits were established by the Banco de Portugal (the central bank), in order to control the state of the economy. According to the financial characteristics of each bank, the state established a limit to the credit granted by the central bank. The development of indirect forms of monetary intervention by the Banco de Portugal, paved the way for market liberalisation. In 1990, the central bank started to define the limits to credit allowed to the banking population, stimulating banks to compete among themselves to gain share. This was a transition phase, critiqued by some because of the insufficient liberalisation it allowed, and by others because of the excess of liberalisation in a period when there were not conditions to the abolition of limits to credit, due to high inflation rates. The transition phase, however, seemed to have been beneficial in the sense it contributed to the general increase of market competitiveness. In 1991, the Banco de Portugal established the complete liberalisation of the system.

Competition between banks increased since then, 1992 being the year of maturity, with the elimination of the last administrative taxes. Increased competitiveness stimulated banks to explore new products and new market niches, that have been overlooked during the placid years. Despite the pressures for efficiency induced by competitiveness, banks continued to show high administrative costs as well as excess of personnel. To overcome this situation, they put more emphasis on cost control, and started to downsize, a management process whose use became possible by the growing utilization of automated processes.

By 1997, the sector continues to experience intense change, with mergers and acquisitions changing the characteristics of the banking landscape, making it difficult to anticipate how banking in Portugal will look like in the next few years, and establishing concentration as the key-word for the time to come.

4.2.2. The Portuguese insurance system

According to a report of the Portuguese Association of Insurers (APS), the number of companies authorised to compete in Portugal continues to rise. The increasing number of companies operating in the Portuguese insurance sector is mainly attributable to the interest of European organizations in the Portuguese market, where a reasonable potential for growth seems to exist (APS, 1995).

To understand the continued growth of the Portuguese insurance sector, one needs to return back to 1975. In that year, and following the 1974 coup d'êtat, all Portuguese insurance companies were nationalised. From 1985, some private companies were allowed to re-enter the market, and in 1986, following the entry into EC, the government decided to privatise most of the insurers. The privatisation program, that actually took effect in 1988, provoked at least two visible consequences: the erosion of the market dominance by state-owned companies, and the increasing range of products available in the marketplace.

The privatisation process produced significant turmoil in the insurance industry, with an astonishing increment in the level of competition. This rather unusual situation proved to be disastrous in the short-term and, according to APS, led the sector to a totalled loss of 25 billion Escudos in 1992. In the same year, four of the six major companies reported financial losses. In 1993, however, total losses declined to 10.5 billion Escudos. According to a report by Coopers & Lybrand, these losses may be due to the fact that the sector was still undergoing a stage of deep structural transformation (Financial Times, 1994). According to the same report, a complete recovery was not expected before 1995, and the future development of the market seemed to be dependent, among other things, on the improvement of service quality and the introduction of innovative new products.

It is important to note that compulsory insurance still accounts for a large proportion of the Portuguese market, with third party liability for motor vehicles and workers' compensation accounting for approximately 50% of the market.

In terms of insurance penetration, Portugal has a low insurance density, measured by premiums per capita. The total premium income, considered as a percentage of national income, is one of the lowest in Europe: in 1990 total domestic premiums were 3.6% of gross domestic product, which ranked Portugal 25th world-wide. The present scenario seems to indicate that a significant development may occur in the future, with the total business of Portuguese insurers accounting for 0.19% of the world market. The demographic characteristics of the country, with a population of 9.86 million inhabitants in 1990 with about 25% aged under 20, suggests future business increases, especially in areas such as life, pension funds and health insurance.

The previous description may help to explain the reason why the number of companies comprising the population did not stop to increase. In 1987 the total

number of companies operating in the market was 55. At the end of 1994, the population of insurance companies was comprised of 95 organizations[2]. The increase in size of the population has been accompanied, however, by a decrease in the total number of employees in the sector, which included 13 217 individuals by the end of 1994, 2.3% less than in the preceding year. The 1994 figure represented 0.29% of the active population in Portugal, against 0.30% in 1993. Despite the increasing number of companies, the market share is highly concentrated, with the 10 largest companies representing, in 1992, 67.7% of total premiums. For the purpose of comparison, it can be said that those companies' total premiums in 1974 accounted for 52.5%.

Following the wake of privatisation, Portugal's largest companies tried to become more efficient. Restructuring programmes produced positive results, with top 20 companies reporting a 23% increase in premium production. According to a Coopers & Lybrand report, the break-even point was reached in 1993, with some analysts predicting an inversion of this trend, due to the impact that hidden losses, such as provisions, may have on future results.

4.3. THE RESEARCH SAMPLE

Knowledge about product innovation processes and outcomes accumulated to date, has been mainly derived from two alternative research approaches: single case studies, and large cross-industry studies. Each approach presents advantages as well as shortcomings. Case studies provide fine-grained analysis of organizational specificity's. Cross-industry investigations provide a more fertile basis for generalisation. Controlled comparisons within a single industry, constitute an appropriate way for generalising findings.

The research universe for this study is comprised of banks and insurance companies operating in Portugal. The selection of banking and insurance as the research universe draws on several reasons: (1) banks and insurance companies are part of a very dynamic and competitive sector, thus constituting a favourable field for studying product innovation; (2) previous empirical research in the financial sector, showed that financial organizations cover a wide range of strategic orientations (Vasconcellos e Sá & Venâncio, 1994); and (3) there are no copyrights in the financial services sector, which means that constant product

[2]For the purposes of this work, this number may be considered artificial because of two reasons: (1) some organizations are legally independent but operativelly integrated in holdings, which means that product development policies and processes are formulated at the corporate level; and (2) some companies, although legally equivalent to any other insurance company, simply act as agents or representatives of foreign companies, without conducting any kind of product development practices. Companies in any of these two conditions have not been considered for sampling purposes. Decisions about which companies to remove have resulted from interviews with executives and from the suggestions of financial experts.

innovation is a necessary condition for not being outpassed by competitors (Meidan, 1984). The low imitation and exit barriers in financial product innovation makes responses to competitors' introductions easier than in most industrial sectors (MacMillan, McCafferty & Van Wijk, 1985).

Fulfilling these three conditions, the financial sector constitutes a promising field to study product innovation. It seemed important to limit the sample to a single sector of business activity, considering that mixing competitive environments could potentially confound results, which means that distinguishing organizational types is of necessity for the development of empirical theories of innovation (Wolfe, 1994).

47 companies participated in the study, of which 18 were banks and 29 insurance companies[3]. These organizations account for market shares of 83.2 % in banking and 76.96 % in insurance activity in Portugal. It is, then, a highly representative sample of the Portuguese financial universe.

4.4. THE STUDY: GENERAL OVERVIEW

In this section, a general overview of the research will be provided. This section will: (1) locate this study among the framework of organizational research methods; (2) present the steps taken while conducting the fieldwork; and (3) present the research instrument.

4.4.1. Research plan

According to Snow and Thomas (1994), there are basically five types of organizational research methods: (1) field methods, (2) computer data bases, (3) experimental simulations, (4) laboratory experiments, and (5) computer simulations. This study can be classified as falling in the field methods type.

Field studies, in turn, can be divided in five major types. Underlying this classification is the technique used for data-collection. The five types considered by Snow and Thomas are the following: (1) direct and participant observation, (2) interviewing, (3) questionnaire survey, (4) field simulation/experiment, and (5) multimethod studies. This field study is of type 3: questionnaire survey.

Questionnaire surveys are typically used to test theory, which befits the goals of the present study. According to the matrix developed by Snow and Thomas (1994), that is defined by the stage of theory development and the purpose of the

[3]Most research in product innovation deals with sample sizes similar or smaller than that of this study. For example, global studies of Clark and Fujimoto (automobile industry) included 29 companies, and Eisenhardt and Tabrizi's (computer industry) considered 36 companies.

theory, this work can be classified as theory testing and descriptive. Given the limited research on the impact of organizational characteristics on the product innovation process and performance, the approach undertaken is eminently exploratory.

4.4.2. Steps in conducting the fieldwork

In this section, the steps involved in the field research will be described. Attention will be paid to the way the research instrument was developed, the steps of the data collection process, and the detailed presentation of the research instrument.

4.4.2.1. Instrument development and refinement

Instrument development and refinement followed the habitual requirements for rigour and relevance. Once the theoretical model was established, a set of sequential, iterative phases have been accomplished. Firstly, and after a scanning of the product innovation literature, scales for measuring the variables under scrutiny were selected. If proper scales for measuring the constructs were not available, they have been generated, departing from literature reviews on their respective fields. As advised by the literature (e.g. Churchill, 1979), several items have been developed for each construct in order to allow for the exploration of several points of view about the same construct.

A second step in instrument development consisted of a series of exploratory semi-directive interviews, aimed to help the identification of relevant issues or variables not uncovered by the review of literature. A 'prototype' of the questionnaire was discussed with a panel of financial experts. This procedure was chosen because of two reasons: (1) the questionnaire was administered to individuals knowledgeable about organizations similar to those participating in the study; and (2) as the subjects participating in the pilot study have not been part of the survey, the first version of the questionnaire could be openly presented and discussed.

The interviews served to iteratively adapt the questionnaire to the characteristics of the sample: after each interview, pertinent suggestions made by the interviewee were included in the questionnaire. This procedure made it possible to work, step by step, with versions more closer to what emerged as the final version. During this phase some items were eliminated, others modified and still others added. Five experts participated in this exploratory phase. After this step, the instrument was submitted to an expert in research methodology, who thoroughly commented every methodological detail.

After conducting the exploratory phases, the instrument was qualitatively pre-tested with thirteen experts: eight banking and five insurance experts. These experts were simply asked to provide their answers to the instrument as if they

were naive respondents, and to signal aspects that appeared to deserve any kind of comment. At this last moment, as expected, only small refinements have been proposed.

Following the suggestions of Ghiglione and Matalon (1985), this preparatory phase aimed to provide answers to questions like: (1) are the questions understood by every subject in the same way, i.e. the predicted way ?; (2) are the questions easy to answer ? (3) do the options for closed questions cover the wide range of potential answers ?; (4) is the order of presentation acceptable ?; and (5) are the relevant topics of discussion considered ? As noted by the authors, a small number of people can be considered adequate for conducting a questionnaire pre-test.

4.4.2.2. Data Collection

As pointed out by Clark and Fujimoto (1991), studies on the topic of product innovation tend to face several difficulties in what refers to data collection. Because the information that is publicly available tends to be scarce in what concerns both the processes and the outcomes of product development, data must usually be collected in the field. As the authors also note, some difficulties with data collection tend to arise, because of two reasons: (1) the confidentiality of most data; and (2) the differences of technical vocabularies. In this study, an additional difficulty was the absence, in most cases, of organized corporate information about the product development process and outcomes. Most companies consequently showed a considerable difficulty in providing answers to some questions, namely those that involved rigorous, quantitative information.

Data was collected using a detailed instrument that included questions about the organizational context, the product innovation process, and the product innovation outcomes and performance. The instrument was divided in three different parts (forms A, B and C), according to the information requested. Form A asks for quantitative information; Form B asks for qualitative information about the organization; Form C asks for qualitative information about product innovation. Such a separation was intended to facilitate the data collection process, by asking informants about topics which they are familiar with. A general overview of the measures included in each form is presented in table 4.1. An English description of items, scales and response formats, is provided in Table 4.8, displayed by the end of the chapter.

Whenever possible, information with an objective tone was asked (e.g. 'Does the company have a department formally and specifically responsible for new product development?' or 'What departments do actually participate in each of the new product development phases that follow'). Objective data was preferentially collected because it is more accurate and less sensitive to retrospective justification and social desirability bias than subjective data (Crampton & Wagner, 1994).

Table 4.1:
Variables and measures

Variable	Measures[4]
Organizational size	Archival
Organizational age	Archival
Number of new products	Index
New product newness	Index
Organizational strategy: self-typing	Scale (Beekun & Ginn, 1993)
Organizational strategy: consistency check	Scale (Beekun & Ginn, 1993)
Idea generation	Scale
New product screening	Scale
Business analysis	Scale
Market testing	Scale
Product innovation programme success	Scale (Dwyer & Mellor, 1983)
Market orientation	Scale

The questionnaire was administered to one (or two) persons in the marketing, R&D, commercial, financial, and human resources departments. Those people were asked to fill the whole questionnaire or the parts (Forms) of it with which they were knowledgeable about. If responses from more than one informant within each organization were obtained, the development of more reliable measures of organizational constructs became possible (Moriarty & Bateson, 1982). It soon proved evident, however, that this planned approach to data collection was unpractical for most companies. Several reasons emerged to explain this unwillingness of the informants to respect the original intention of having more than one informant in each organization, including lack of time, lack of motivation, and non-existence of product innovation departments. These reasons made it impossible to distribute all the anticipated questionnaires in each of the companies. In the case of companies that declined to participate with more than one response, the data collection process followed the recommendation to use the most knowledgeable informant (Huber & Power, 1985), in this case someone from the R&D or marketing department.

Table 4.2 presents the frequencies of informants by company. As displayed, 120 answers were collected in 47 companies.

[4]In the case of scales, if no further indication is provided, the scale has been specifically designed for this study.

Table 4.2.
Number of informants by company

Number of informants in the company	Frequency
1	20
2	9
3	3
4	6
5	5
6	4
Total number of answers	120
Total number of companies	47

In those cases where there was two or more informants with different functional backgrounds, the differences between their responses were tested. A Kruskall-Wallis Anova was runned testing intraorganizational differences in terms of strategy classification. Strategy was selected as the focal variable because every subject classified the its organization's strategy. Results for the 24 companies with informants from different backgrounds, showed no significant differences (at a .05 significance level) in none of the participating firms. These results, showing no significant intraorganizational differences, demonstrate that informants with different backgrounds can be considered to be consistently characterising their organizations.

Considering that this research focuses on the organizational level of analysis, data were further aggregated. Many aggregation approaches have been proposed (Kumar, Stern & Narus, 1993). In this work, data have been aggregated through average. To do so, the scores obtained from each organizations informants have been averaged in order to derive a single organizational score for each construct. Before aggregating the results, interrater reliability (IRR) was calculated as suggested by James, Demaree and Wolf (1984). Following Susman and Ray (1996), interrater reliability within organizations for each construct, was calculated by averaging the interrater reliability for the organizations that provided two or more responses. IRR results are presented in Table 4.8.

The data gathering proceeded in different approaches and in several steps. Whenever a known informant existed, organizations were contacted personally. This contact was made in order to obtain the cooperation of the firm. It consisted in the presentation of the research goals, the type of instrument, in assuring the confidentiality of data, respondents and organizations, and in the presentation of the potential advantages arising for companies participating in the study. To enhance data accuracy, the questionnaire included not only the questions to be answered but also a general presentation of the research goals, detailed instructions for answering, and the name and telephone number of the author so that respondents could ask any question about the research or the instrument. Actually, only a very small number of people used this line of communication.

Hopefully this could be understood as a reaction to the ease and clarity of response. In order to reduce the potential for social desirability bias, several strategies were attempted: (1) subjects were explicitly asked to give their answers according to how the organization is, and not to how, in their opinion, it could or should be; (2) if possible, multiple informants were used in each site; and (3) questions were as objective as possible, in order to limit the potential for social desirability bias, considering that objective questions are less susceptible to biasing.

If a knowledgeable informant did not exist, organizations were contacted in one of the following ways: (1) banks were contacted by the Instituto de Formação Bancária (IFB, Banking Training Institute, of Portuguese Banking Association); or (2) a mailing was made, including all the previous material plus a more detailed presentation of the study. In the first case, IFB established a formal written contact. These contacts were made in order to remove possible misunderstandings about the nature of the work's goals and to make clear the support of IFB to the research. A further personal contact, by the author, served to make more detailed explanations of the research objectives and about the data needed from the organization. The lack of success of this formal approach (of a list of 16 contacts, before the author's personal contact only two answers, both affirmative, have been obtained), led to the abandonment of this procedure, and to the adoption of a more informal approach to insurance companies. To increase the number of contacts, in each interview, the interviewee was asked to provide a possible informant in a previously not contacted organization. Most of the subjects agreed to indicate people in other companies, which turned this snow balling (Johnson, 1990) process into a highly effective one in terms of establishing a network of contacts in the sector. 72 organizations (including banks and insurance companies) were contacted personally, and 9 organizations, where personal contacts were not available, were contacted by phone and/or mail. Considering that every bank with headquarters in Portugal has been contacted, it means that 20 insurance companies were not contacted. These companies were excluded because of one of two possible reasons. First, some legally independent companies are actually part of holdings. The responsibility for developing new products in these firms is, in most cases, a task centralised at the corporate level. For practical reasons, then, these companies, as suggested by informants, have been considered as forming a single case with mother firms. The other cases not considered, included those companies that limit themselves to work as representatives of foreign companies, without any kind of product development activity, and companies operating in business niches that made them inappropriate for the purposes of the study (e.g. reinsurance companies). The market-share of the not contacted companies was invariably inferior to 1%, and often inferior to 0.00%.

When the instrument was completed, it was reviewed in order to detect possible problems of (in)completeness. In case of necessity, respondents were contacted again, to ensure that the questions left unanswered would be filled.

Companies were told that they would obtain a managerial-oriented research report by the end of the study. This report, to be exclusively delivered to participating firms, would provide information adequate for benchmarking purposes, once it would allow the comparison between a firm's practices and those shown by the data to be the best practices. Reasons for declining to participate, were primarily due to lack of time of the potential subjects and to the implementation of organizational restructuring processes by the time the study was carried out, including merger processes, which caused significant internal pressure and turmoil.

The measurement of organizational characteristics through the reports of key informants doesn't go without costs. As noted by Phillips (1981), respondents may not have the knowledge or the neutrality needed to characterise the variables under scrutiny. The limitations deriving from the weaknesses of key informant reports should be taken into account, and the results of the study interpreted with this limitation in mind. It should be noted, however, that key informant perceptions may be a valid measurement approach to organizational characteristics if informants are knowledgeable individuals. Empirical evidence accounting for this validity can be found, for example, in Shortell and Zajac (1990).

4.4.3. The research instrument

In this section, the instrument used in the study is presented. According to the guidelines provided by textbooks, elaboration of the instrument started with a qualitative orientation and followed by quantitative testing. In line with methodological rules, a questionnaire was developed and subsequently pre-tested as the main instrument of research. The development of the questionnaire has been accompanied by a literature review and a series of interviews with academic and professional experts in the areas of strategic management and marketing.

Some aspects of the questionnaire development process will now be discussed, namely (1) the origin of the instrument; (2) translation procedures; (3) questionnaire form and content; (4) reliability and content validity; and (5) the process used for the selection of informants:

(1) Origin of the instrument. Some scales comprising the questionnaire have been inspired in existing instruments. The adoption and adaptation of already developed scales is a common procedure in the social sciences. As argued by psychometricians, the making of new measures for each situation can be a wasteful effort (Nunnally, 1978; Peter, 1981). Thus, new scales were only developed for those cases where there were not currently available measures

(2) Translations. All scales derived from already existing English-written instruments have been translated to Portuguese by three different and

independent translators. Disagreements were discussed until a consensus was achieved. The author and a native-English speaker were among the translators. Later on, three other translators reversed the Portuguese version scales again to English. The process concluded when a consensus between the original version and the retroverted version was achieved;

(3) Questionnaire form and content: In a series of interviews with financial experts, it was discussed to what extent the questionnaire's items were measuring the variables identified in the literature review. After introducing pertinent comments, the questionnaire was presented to another financial expert, who commented both its form and content. As suggested by the survey research literature (Edwards & Thomas, 1993), experts were asked to make comments about the language used, the phrasing of items and the display of information, to signal equivocal sentences or terms, and to provide any other suggestion that could improve the instrument;

(4) Reliability and content validity. Scholars and financial executives screened and edited the items, in order to improve content validity. Reliability was tested using Cronbach's alpha. Reliability coefficients for the generality of the scales, are discussed below (see Table 4.8).

(5) Selection of informants. The selection of informants was made on the basis of access to the kind of knowledge required to answer the instrument. As noted by Johnson (1990), this is a current and valid procedure, since the selected informants are able to provide a representative picture of the topics under analysis.

4.5. OPERATIONALISING THE VARIABLES

In this section, the way in which variables have been operationalised will be presented and justified. For a summary, Table 4.8 lists the operationalisations of variables involving the development of scales.

Organizational size. As discussed by Damanpour (1992), different measures of size can be used in innovation research, depending on the nature of the study and, consequently, on the types of organizations considered. In this study, a personnel measure has been used. The personnel measure 'number of employees' was selected because it can have a powerful influence on several internal processes. It is also the most commonly used measure of size, with some authors recommending its use as the best way of operationalizing this variable (Kimberly, 1976) The number of employees may influence, for example, the organizational design, the degree of formalisation, the number of hierarchical levels, etc. The impact of the number of employees on organizational structure and the division of labour is on the basis of techniques like downsizing and reengineering. As expected, there is a high correlation between size and financial or market

indicators like total assets ($r = .89$, $p<.000$), net results ($r = .76$, $p<.000$) and market share ($r = .76$, $p<.000$).

Organizational age. Organizational age is a currently used measure in innovation research (Aiken & Alford, 1970; Pierce & Delbecq, 1977; Kimberly & Evanisko, 1981). This variable is simply operationalised by counting the number of years passed since the foundation of the company. The absolute age of the organization, or the length of time it has been in existence, is an appropriate measure of age, since it provides a direct and objective way of operationalisation.

Organizational strategy. In order to assess the strategic positioning of the firms composing the sample, it was necessary, first of all, to chose a framework for analysis. The selection of such a framework should be made in function of four evaluative criteria: (1) the framework should be theoretically compatible with the perspective undertaken in the study, that is, it should adopt a holistic perspective of organizations; (2) it should be mainly focused on the product-market orientation of the firm; (3) it should have proven to be a valid and useful framework for organizational analysis, i.e., more than an elegant theoretical construction, a comprehensive and empirically tested approach is of necessity; and (4) it should be parsimonious and able to capture the basic strategic properties of firms, based on a small number of dimensions.

The Miles and Snow typology seems to respect all these four criteria: it is a configurational (Doty et al., 1993) and product-market centred approach (Hambrick, 1980), it has received a reasonable (moderate to strong) amount of empirical support (e.g. Shortell & Zajac, 1990; Zahra & Pearce, 1990; Doty et al., 1993), and it is a parsimonious model, reducing organizational forms to four pure types (Miles & Snow, 1978).

The Miles and Snow typology provides a dynamic model about how organizations align themselves with their environments. The authors describe it as a model which incorporates and expands concepts introduced in the strategy literature by scholars as prominent as Chandler (1962), Weick (1979), and Child (1972). The influence of Chandler is apparent, for example, in the relation between the entrepreneurial and administrative problems: structure follows strategy. The influence of Weick lies in the fact that organizational players enact environments. Because different actors develop different interpretations of the same events, several strategies may emerge among organizations competing in the same industry. The diversity of organizational action is also a milestone of Child's work: organizations do not respond monolithically to their environments. On the contrary, they make strategic choices that generate diversity in the way the environment is approached.

The typology asserts that there are three broad problems that need to be addressed in the management of the adaptive cycle: the entrepreneurial, administrative, and

technological problems. The way organizations handle and solve these problems, is expected to result in consistent and predictable patterns of activity.

In an article concerned with strategy measurement, Snow and Hambrick (1980) presented four different methods for strategy classification: investigator inference, self-typing, external assessment and objective indicators.

In the investigator inference approach, the researcher collects all the significant information available, and assesses the organization's strategy. As noted by Snow and Hambrick, this measurement approach has few advantages (the most important of which is the impressive amount of information that is potentially obtainable) and several shortcomings (including the difficulty of applying this approach to large samples, perceptual biases, and the influence of implicit theories in interpreting data). Self-typing consists in the characterisation of an organization's strategy according to its own representatives (especially top managers). There are some advantages inherent to this approach (namely the fact that managers' perceptions are one of the determinants of the organization's strategy, and the large samples obtainable through this data collection type) as well as some weaknesses (the reluctance of some managers in categorising their 'unique' and therefore unclassifiable organization, and the variance in managers' perceptions of organizational strategy). External assessment consists in asking competitors, customers or experts for classifying an organization's strategy. The main disadvantages of this approach are the discrepancies between raters and their limited (incomplete, outdated) organizational knowledge. Among the advantages is the fact that this method is particularly well suited for studies involving a large number of organizations and the agreement within expert panels obtained in several empirical studies. Objective indicators can be derived from published data. The advantages are related to the avoidance of perceptual bias and the neutral nature of the data. The main disadvantage refers to the impossibility of analysing unpublished data.

Considering the strengths and weaknesses of each method, it seemed appropriate to use more than one of the methods considered by Snow and Hambrick. The methods selected to be used in this study include external assessment, self-typing, and a consistency check between declared and actual strategy. The utilization of these approaches seemed to be appropriate because a large number of organizations needed to be tested (which discouraged the use of investigator inference), and because the objective indicators approach is a parsimonious but not a comprehensive one. The multidimensional character of the Miles-Snow typology recommends the use of comprehensive approaches (Ginn, 1990).

Due to the disadvantages of the objective indicators and investigator inference approaches, the self-typing and external assessment measures were combined. Respondents were also asked to characterise their companies according to the way they manage the adaptive cycle.

Self-typing and external assessment. Informants were asked to make a self-assessment of their organization's strategy. To do so, a brief description of each Miles and Snow's strategic type was provided, and informants invited to classify their organization's strategy (self-typing) as well as competitor strategies (external assessment) according to these descriptions. The descriptions have been derived from the work of Beekun and Ginn (1993), with a slight modification: they do not name any of the strategies, given that some labels may tend to be more positively perceived than others. This may act as a potential source of bias.

Consistency check. As a check for self-assessment, each informant was asked to characterise its organization according to the way it handles the management of the adaptive cycle. Following the questionnaire developed by Beekun and Ginn (1993), defenders are expected to obtain lower results than analysers, and analysers expected to rate lower than prospectors. Given the inconsistent nature of reactors, their pattern of response is unpredictable. This consistency check served to evaluate the degree of consistency between the strategic type considered by informants, and the management of the adaptive cycle in their organizations.

Market orientation. Narver and Slater's (1990) nine item five-point scale was used to assess the degree of market orientation of the firm. This scale intended to assess the degree of openness to the market. It includes items on measurement of service quality, product differentiation, knowledge of competitors, etc.

Pre-development operations. Pre-development operations were mainly assessed with 5-point rating scales. Most of these rating scales were specifically created for this study, trying to capture the way a company manages the several pre-development stages involved in product innovation. Pre-development assessment included scales about techniques for idea generation (six items), idea screening (three items); and organizational designs for new product development (six items). These scales intended to collect information about the degree of utilization, by the organization, of several practical approaches for preparing new product innovations.

Development operations. To assess the sophistication of product development operations, business analysis (five items) and market testing (three items) were measured by 5-point Likert-type scales. These scales attempt to capture the main characteristics of the product development process as presented in the literature (e.g. O'Shaughnessy, 1984).

Measures of pre-development as well as of development resulted from a literature review mainly focused on the works of Kotler (1988), Edgett (1992), Cooper (1993) and O'Shaughnessy (1992). Pertinent suggestions from interviewees were also considered. These scales were expected to provide a detailed picture of the extent of utilization of some currently referred techniques for developing new products.

Number of product innovations. To obtain quantitative assessments of the several product innovation outcomes and performance, a table has been elaborated, which allowed for the possibility of collecting detailed information without harnessing the confidentiality of the products involved, a matter that emerged as a sensible issue during the qualitative interviews. This table allowed data collection on the number of new products launched in 1994 (the year prior to data collection), the product innovations newness degree, new product success, and product innovation programme success.

As referred, the number of new products was operationalised by asking informants the number of new products launched in the last year. The reason accounting for the selection of a single year as the period under analysis, was due to the absence, in a vast majority of organizations, of records concerning the number of new products launched in previous years.

Newness of product innovations. The newness of the product innovations was measured by asking subjects to indicate the number of new products falling in the Booz, Allen, & Hamilton types (Kotler, 1988): new to the world products, revisions and improvements of existing products, additions to existing product lines, cost reductions, and repositionings. In order to reduce all the newness information to a single index, the aforementioned product types have been reduced to two general product categories: new products (including products new to the world and product additions) and adaptations (including revisions and improvements, cost reductions, and repositionings). To calculate the newness degree of the company's product portfolio, the sum of the total number of innovations falling in the 'new products' category was multiplied by two, and summed to the total number of products falling in the adaptations category.

Product innovation success. To operationalise the degree of success of product innovation, subjects were asked to classify each of the firm's product innovations in a success continuum ranging from 1 (much worst than expected) to 5 (much better than expected). In order to reduce the information to a single index, the following formula has been computed: (number of new products in category 1 × 1) + (number of new products in category 2 × 2) + (number of new products in category 3 × 3) + (number of new products in category 4 × 4) + (number of new products in category 5 × 5). The resulting index provides a composite measure of how successful the firm's new product innovations are.

Product innovation programme

An evaluation of the firms' new product development programme has also been included, based on the items presented by Dwyer and Mellor (1993). The scale collects information on the following aspects: the degree of achievement of the programme's financial goals, programme's impact on company sales and profits, programme's success compared with competitors' programmes, and the overall success of the programme. This variable can be distinguished from the product

innovation success variable, because of their different focus: product innovation success exclusively refers to individual product innovations, while programme success integrates the product innovation function in the context of organizational strategy and functioning. They can consequently be considered as two different yet complementary measures of product innovation performance.

4.6. PRELIMINARY ANALYSES

Prior to the theoretical context of the research model, a preliminary analysis was conducted. First, and in order to reduce the number of variables and to choose the best number of factors, a principal component factor analysis followed by a varimax rotation was run. This procedure allowed the extraction of the dimensions underlying the original set of variables and consequently the identification of the appropriate variables for subsequent analysis. Items with low item-factor correlations were eliminated. The final version of the research instrument is presented in Table 4.8.

An initial assessment of scale reliability was then conducted using Cronbach's alpha. This phase allowed to purify measures by deleting items as necessary to improve instrument reliability. As will be seen, all reliability coefficients are equal or above .65, thus meeting adequately research standards (Deshpandé et al., 1993).

Organizational strategy

Applying a principal component analysis to all items on organizational strategy, four factors have been found, explaining 68.5% of the total variance (Table 4.3).

One of the factors (factor IV, with 2 items on internal versus external orientation), has been removed, because the resulting scale showed a low reliability coefficient (α=.39). This factor explained 10.5% of the variance.

Table 4.3.
Principal component analysis of organizational strategy

Item description/Factor	I	II	III	IV
Technological sophistication of financial equipment	.78	.19	.29	.16
Technological sophistication of non-financial equipment	.73	.28	.13	.13
Centralization vs. decentralization	.75	-.04	.10	.04
Early timing of new product launch	.15	.71	.45	.12
Launching new products before competitors' results	.11	.84	.06	.08
Range of product assortment	.25	.04	.83	-.06
Total number of product innovations compared with competitors	.24	.42	.71	.08
Behavioral vs. goal assessment	.17	.27	-.07	.73
Internally vs. externally-based reward structure	.10	-.01	.05	.73
Eigenvalue	3.38	1.28	1.12	1.05
Percentage of explained variance	33.8	12.8	11.2	10.5

The first factor (3 items), labelled 'technology', explains 33.8% of the variance and contains all technology items from the original scale. The reliability for this factor shows an alpha of .85 after removing an item that was in the original scale ('Centralised vs. decentralised' item). The scale's alpha before purification was α=. 73.

The second factor (2 items), called 'proaction', explains 12.8% of the variance and contains items on the proactive organizational behaviour. The reliability of this new scale shows an alpha of α=.68.

The third factor, called 'product assortment' explains 11.2% of the variance and contains items on the degree of the firm's product diversity. The Cronbach alpha for the scale is of α= .72.

Market orientation

A principal component analysis to all items on market orientation, extracted three factors, explaining 69.9% of the total variance (Table 4.4). One of the factors, factor III, composed by two items was dropped. The reasons accounting for removing this factor were: (1) the Cronbach alpha for the new scale was clearly below the acceptability threshold (α=.42), and (2) the loading of the 'Customer interest always comes first' item was higher on factor I than on factor III, a result that, theoretically, was unexpected. The two items loading in the removed factor were about the importance attached by the company to the interests of customers.

Table 4.4
Principal component analysis of market orientation

Item description/Factor	I	II	III
Regular measures of quality	.60	.55	-.07
Product development based on market information	.74	.37	.10
Knowledge of competitors	.77	.14	-.34
Reliable information on the company's products	.68	.33	.07
Degree of customer-orientation compared with competitors	.07	.87	.16
Competition based on product differentiation	.29	.76	-.12
Product superiority compared with competitors	.23	.77	.04
Belief in the customer as the raison d'être of the business	.01	.07	.92
Customer interest always comes first	.69	-.03	.45
Eigenvalue	3.92	1.22	1.15
Percentage of explained variance	43.5	13.5	12.8

Of the remaining factors, the first one, labelled 'Market knowledge' (4 items), explains 43.5% of the variance. It includes items on the quantity and quality of the firm's information about products, customers, and competitors. The 'Regular measures of quality' item was kept because it added theoretical clarity to the factor. The Cronbach alpha of the market knowledge scale is of α=.81.

The second factor (3 items), explaining 13.5% of the variance, was labelled 'Product evaluation', as it includes items about how the company evaluates the quality of its products, considering their degree of market orientation, differentiation, and relative value compared with competitors' products. The reliability of the product evaluation scale is of α=.79.

Pre-development

A principal component analysis to all items on pre-development, extracted three factors, that, together, explain 56.8% of the total variance (Table 4.5).

Table 4.5
Principal component factor analysis of pre-development operations

Item description/Factor	I	II	III
Forecasting	.62	.29	.21
Brainstorming	.64	.43	.05
Gap analysis	.71	.08	.11
Dissection of competitive products	.59	-.10	.25
Screening by product policy	.63	.20	.39
Check lists	.70	.24	.08
Project groups	.45	.66	.18
Product innovation committees	.02	.84	.24
Temporary committees	.19	.81	.10
New product managers	.20	.07	.77
Product managers	.40	.01	.69
Eigenvalue	5.26	1.41	1.28
Percentage of explained variance	37.9	10.1	9.1

The first factor (6 items) was called 'Idea generation and screening', and explains 37.9% of the variance. It contains items on idea generation for new products and idea screening. The reliability of the idea generation and screening scale is of α=.80.

The second factor (3 items), was labelled 'Ad hoc designs', as it contains the items on temporary, ad hoc ways of organizing for new product generation. The factor explains 10.1% of the variance. The new scale has a Cronbach alpha of α=.79.

The third factor (2 items), was called 'Permanent designs' for it includes stable organizing approaches to product development. This dimension explains 9.1% of the variance and shows a Cronbach alpha of α=.73.

Development

A principal component analysis to all items on development, extracted two factors, that, together, explain 68.7% of the total variance (Table 4.6).

Table 4.6
Principal component analysis of development operations

Item description/Factor	I	II
Sales estimates	.78	.01
Initial sales estimates	.78	.22
Sales per substitution	.78	.29
Repeated sales	.76	.33
Costs and benefits estimates	.73	.23
Mini-market test	.37	.79
Full-market test	.09	.90
Eigenvalue	3.78	1.03
Percentage of explained variance	54	14.7

The first factor (5 items) was labelled 'Business analysis'. The factor explains 54% of the variance. The new scale has a Cronbach alpha of α=.86.

The second factor (2 items), was called 'Market testing' and explains 14.7% of the variance. The reliability of the new scale is of α=.65.

Product innovation programme

A principal component factor analysis to all items on product innovation programme extracted a single factor, explaining 71.5% of the variance (Table 4.7).

Table 4.7.
Principal component factor analysis of programme's results

Item description/Factor	I
Achievement of financial goals	.86
Impact on sales and profits	.87
Ratio between product innovation profits and programme's costs	.71
Success compared with competitors' programmes	.87
Overall programme success	.91
Eigenvalue	3.58
Percentage of explained variance	71.5

The factor extracted (5 items) was called 'Product innovation programme'. The Cronbach alpha for the scale is of α=.91. One item of the original scale ('Ratio between product innovation profits and programme's costs') was removed because it showed the lowest communality, and its dropping improved the scale's reliability from α=.89 to α=.91.

Table 4.8 provides a general overview of the scales, and reliabilty and interrater reliability coefficients.

Table 4.8.
The research instrument: Scale/item description, scales reliabilities, and IRR

Technology	**(α =.85; IRR = .78)**
Technological sophistication of financial equipment	
Technological sophistication of non-financial equipment	
Proaction	**(α = .68; IRR = .85)**
Early timing of product introductions	
Launch of new products before waiting for competitors' results	
Product assortment	**(α = .72; IRR = .83)**
Range of product assortment	
Total number of new products, compared with competitors	
Market knowledge	**(α = .81; IRR = .92)**
Regular measures of product quality	
Product development based on market information	
Knowledge of competitors	
Reliable market information about company's products and services	
Product evaluation	**(α = .79; IRR = .92)**
Superior customer orientation compared with competitors	
Competition based on product differentiation	
Product superiority in relation to competitors	
Idea generation and screening	**(α = .80; IRR = .86)**
Forecasting	
Brainstorming	
Gap analysis	
Dissection of competitive products	
Idea screening in function of product policy	
Check lists	
Ad hoc designs for product innovation	**(α = .79; IRR = .76)**
Project groups	
Product innovation committees	
Temporary committees	
Permanent designs for product innovation	**(α = .73; IRR = .73)**
New product managers	
Product managers	
Business analysis	**(α= .86; IRR =.85)**
Sales estimates	
Initial sales estimates	
Sales by substitution	
Repeated sales	
Market testing	**(α=.65; IRR = .82)**
Mini market test	
Full market test	
Product innovation programme	**(α=.91; IRR = .92)**
Degree of achievement of financial goals	
Impact on sales and profits	
Success compared with competitors' programmes	
Overall programme success	

To accommodate the multidimensional nature of the constructs shown in Table 4.8, the items for each construct were averaged to form scales. The scales, in turn, serve as the indicators for the constructs in the model.

4.7. SUMMARY

This chapter described how this study's research approach unfolded. As explained, the constructs were operationalised with a mix of original and adapted scales, derived from the literature review, field interviews and pre-test results.

Then, a preliminary assessment of reliability and construct validity was undertaken. Drawing from the original theoretical model and revised conceptualisation and measurement of the constructs, the research model was developed. This model was operationalised as a multiple indicator structural model. Measurement properties and relationships between constructs will be tested by using a partial least squares approach to this modeling. Subsequently, several regression analysis will be run, in order to provide a complementary, detail-oriented perspective, on the relationships between manifests.

5. Results and Discussion

5.1. PREPARATORY ANALYSES

Before proceeding with the presentation and discussion of the results, some preparatory analyses have taken place. In this section, these analyses are presented. They include the comparison between participating and non-participating companies, and the differences between banks and insurance companies.

5.1.1. Contrasting participating and non-participating organizations

Characteristics of respondent and non-respondent organizations were compared to check for possible systematic bias in the results, due to non-response. Respondents and non-respondents were compared in terms of total assets and profits. These measures were selected because they are objective and generally available in the reports of the banking and insurance associations.

The results show that participating companies tend to be bigger (to have higher total assets) than non-participating companies (χ^2=23.02, p=.00), and also more profitable (χ^2 = 13.41, p = .00).

These results suggest that larger and more profitable organizations were more likely to respond. This may be due to two sources of (non)response considered by Tomaskovic-Devey et al. (1994), namely the capacity and the motive to respond. In fact, smaller firms may consider it more difficult to assemble the information requested for filling organizational surveys, and less profitable firms may have stronger motives for not disclosing information about the organization. No matter what the possible reasons for non-response are, the fact is that the sample may be biased towards larger and more profitable companies.

5.1.2. Contrasting participating banks and insurance companies

In line with previous research on product innovation (e.g. Cooper et al., 1993), it was decided to include banks and insurance companies under the same research sample. The rationale for this decision has to do with the fact that they can both be considered as part of the financial services industry. To test the existence of significant differences between participating banks and insurance companies, the composite financial measure referred by Snow and Hrebiniak (1980) was used. This measure consists in the ratio of total income to total assets. There are several reasons for using this ratio: (1) it is an objective measure of performance; and (2) considering that there are differences in the accounting methods of companies,

even within the same industry, it is appropriate to chose a method that may not be affected by these differences in accounting practices.

Financial data used to compute the ratio, came from the annual reports of APB and ISP, the banking and insurance associations.

To test the existence of differences between banking and insurance in terms of the Snow and Hrebiniak composite financial measure, a Wald-Wolfowitz runs test was used. The results showed no significant differences between the two groups ($z = -.691$, $p = .489$). This result allows the inclusion of both sectors in the same universe, since groups show no significant differences in terms of performance according to the referred criteria. Considering the blurring of banking and insurance, and the emergence of a financial industry where banks and insurance companies directly or indirectly compete in several areas, it seemed appropriate to include these two sectors together in the same research universe.

5.2. DESCRIPTIVE STATISTICS

Data is examined from three perspectives. The first approach is to look at the aggregate descriptive results to develop a general impression of the sector as a whole. The second approach presents and analyses a structural model of product innovation performance. The third approach consists in a series of regression analyses that attempt to explore specific details that may emerge within the most general context of the structural model.

Section 5.2 provides the descriptive statistics for the variables considered in the study. To make the descriptive statistics more reliable, outliers have been 'cleaned' from the analyses. The decision of which answers to exclude as outliers, was made on the basis of a quantitative rule: observations falling outside the ±2 standard deviations around the mean were considered indicative of values to remove (STATISTICA™, 1994). Outliers have been substituted by the average response for the total sample.

Table 5.1 presents the Pearson product-moment correlations among the variables to provide a general picture of their relationships. Before entering the examination of the relationships among constructs, the relationships among variables within constructs will be briefly discussed. Several factors deserve to be analysed. Organization variables size and age are strongly correlated ($r = .50$, $p<.001$). The same happens between the number and newness of product innovations, with an almost perfect correlation ($r = .95$, $p<.001$). Of course, this may mean that these measures overlap. The very strong, near perfect correlation between number and success of product innovations, is also indicative of overlap between product innovation measures. There are at least two possible reasons for explaining these results: on the one hand, all product innovation measures are derived from the number of new products; secondly, the number of new products

may be the most objective anchor available for respondents to characterise the product innovation outcomes and performance of their organization. These may certainly constitute reasons accounting for the redundancy and potential lack of discriminant validity between these measures. This topic will be rediscussed later, in the PLS analysis of the measurement model. It is also important to note that strong correlations exist between market knowledge and several operations variables, as well as between ad hoc designs and idea generation with several operations variables. Technology also shows many significant interrelationships, particularly with operations variables.

The quite high intercorrelations between several indicators suggests that the different variables used for assessing some constructs (especially operations, product innovation outcomes and product innovation performance) may be measuring the same central tendencies in the sample firms. As referred, possible measurement problems will be discussed later.

Table 5.1
Correlations and reliability estimates[1]

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Size	–															
2. Age	.50***	–														
3. Number	.40**	.07	–													
4. Success	.39**	.07	.98***	–												
5. Newness	.36*	.07	.95***	.94***	–											
6. Knowledge	.12	-.10	.14	.18	.20	(.81)										
7. Assortment	.23	.09	.22	.21	.27	.19	(.72)									
8. Proaction	-.03	-.23	.17	.16	.19	.33*	.36*	(.68)								
9. Evaluation	-.14	-.37*	.13	.14	.20	.66***	.13	.60***	(.79)							
10. Idea	.04	-.14	.28	.32*	.31*	.48**	.28	.36*	.46**	(.80)						
11. Ad hoc	-.01	-.08	.08	.15	.16	.56***	.36*	.48**	.50***	.54***	(.79)					
12. Perman.	.08	.03	.25	.26	.26	.31*	.20	.09	.24	.50***	.20	(.73)				
13. Business	-.15	-.31*	.12	.15	.14	.41**	.23	.33*	.58***	.76***	.55***	.39*	(.86)			
14. Testing	.13	.05	.13	.18	.16	.55***	.24	.16	.32*	.51***	.48**	.36*	.58***	(.65)		
15. Program.	.05	-.16	.33*	.35*	.35*	.39**	.40**	.38**	.32*	.32*	.48**	.07	.32*	.02	(.91)	
16. Tech.	-.14	-.26	.07	.11	.13	.42**	.43**	.47**	.42**	.52***	.56***	.21	.44**	.14	.44**	(.73)

[1] Reliability estimates (Cronbach alpha) are indicated along the diagonal. Sample sizes varied slightly because of missing data.

* p<.05
** p<.01
*** p<.001

The strong intercorrelations between measures of product innovation performance are, however, common in the literature as referred by Cooper et al. (1993), which suggests that the refinement of measurement instruments for product innovation performance must be considered a priority in this research field.

Next, a brief analysis of descriptive results will be provided, on a variable by variable basis. These descriptions will present a general picture of the organizations as well as of product innovation practices of participating companies.

5.2.1. Organizational size and age

Organizations included in this study varied considerably in size: the smaller organization has only 3 employees, while the larger employs 9549 people. The average organizational size is 1280 employees (SD = 2044). In addition, organizations varied greatly in age (average age = 45.5 years; SD = 47.7). Upper and lower limits are on the 3 and 153 years of organizational existence. The inclusion of organizations with diverse characteristics, yelding a heterogeneous sample, can be viewed as beneficial. Having organizations with different ages and diverse sizes, increases the confidence in the generalizability of results.

Companies were asked to indicate if they have formally established marketing and R&D departments. 34 of the participating companies reported the existence of a marketing department, but only 18 gave an affirmative answer when asked to indicate if there was or not an R&D department.

Of all the analysed companies, only 16 have both a marketing and a research and development (R&D)[5] department. 18 companies have a marketing but not an R&D department, 11 have neither a marketing nor an R&D department, and 2 companies have an R&D department but not a marketing department.

The previous results show that most companies considered the importance of having a formal department of marketing, but that about only one-third of the organizations included has a formal department for R&D/product innovation. This may mean that product innovation is not yet being perceived by most organizations as a strategic priority, to be autonomised at the departmental level.

The average number of employees in the marketing department was of 8 (SD = 7.45). In the research and development department, the average number of employees was 4 (SD = 3.01). As these results illustrate, the average number of employees in R&D departments (when available) is half the number of marketing departments.

It is interesting to note that the number of employees in the R&D department is not significantly correlated with the number of product innovations ($r = .24$, n.s.). The number of employees in the marketing department, however shows a statistically significant correlation with the number of new products ($r = .33$, $p<.05$). These results should be interpreted carefully, but it is possible to hypothesise that the greatest investment in marketing (more marketing departments with more people assigned) is proving its benefits in terms of product innovation. On the contrary, the comparatively minor investment in R&D doesn't prove to impact the firm's product innovation outcomes.

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[5] The generally adopted label for the equivalent to an R&D or product innovation department in the Portuguese financial sector, is 'Technical area'. However, and considering that the label 'R&D' provides a more current description, it was decided to use this designation.

5.2.2. Organizational strategy

Of the 47 organizations participating in the study, 27 classified themselves as analysers, 12 as prospectors and 8 as defenders. A different picture is provided when it comes to the modal distribution of external classification, with defenders becoming the most frequent strategic type: 18 organizations. Analysers are the second most frequent strategic type, with 17 organizations. 6 organizations were classified by their competitors as prospectors, and 2 as reactors. For a more detailed analysis of self-classifications and external assessments, see Tables A3.1 and A3.2, Appendix 3. External classifications were obtained by asking respondents to classify each competitor according to the descriptions of Miles and Snow's strategic types. The modal response was used to determine the predominant strategic type assigned to each company.

Additionally, and as expected from previous research, the means on the Likert-scaled questions composing the consistency test, were lowest for defenders and highest for prospectors, with analysers lying between these two groups. Means and standard deviations are presented in Table A3.3.

Strategy self-typings were compared with answers to Likert-scaled questions after the computation of a total score on these questions for each organization. The significant results obtained by a Kruskall-Wallis one-way ANOVA supported the validity of the classifications ($\chi^2 = 6.02$, $p < .05$). These results show that the Likert-scaled questions support the strategy self-classifications. Considering these results, further analyses will be conducted using self-ratings as the basis for strategy classification, because they provide a richer and more detailed way of assessing organizational strategy.

5.2.3. Market knowledge

The domain where organizations have a better developed market knowledge is knowledge of competitors (Mean = 3.70, SD = 1.01). Although regular measurements of product quality correspond to the lowest scoring item (Mean = 3.07, SD = 1.15), companies claim to have moderately reliable market information about their products (Mean = 3.48, SD = .77). It should be noted that, on the whole, respondents reported only a moderate level of market knowledge.

Results for items of the market knowledge scale are presented in Table A3.4. The items range between 1 and 5, where 1 means 'does not describe us at all' and 5 'describes us completely'. The value 3 corresponds to the neutral mark.

5.2.4. Product evaluation

Detailed results for items on the product evaluation scale are presented in Table A3.5. The scale ranges from 1 (= does not describes us at all) to 5 (= describe us completely), with 3 being the neutral point.

Results show that, in general, companies have moderate perceptions of the superiority and differentiation degrees of their new product innovations, with the means for the three items falling in the neutral zone.

5.2.5. Idea generation and screening

The degree of utilization of idea generation and screening techniques for new products was assessed with a 6 five-point Likert type items (1 = never, 5 = always). Results obtained for each technique are displayed in Table A3.6.

As revealed by the results, participating companies make low to moderate use of idea generation and screening techniques. Brainstorming and idea screening in function of product policy are used more often than forecasting, gap analysis and check lists but, nevertheless, their rate of utilization falls in the neutral zone. The most regularly used technique is the dissection of competitive products, with the highest mean value (M = 3.69) and the lowest standard deviation (SD = .81).

5.2.6. Business analysis

To assess the depth of utilisation of business analysis techniques, subjects were asked to classify how often their companies make use of several of these techniques. The average results and standard deviations for the five business analysis techniques are presented in Table A3.7. The scales range between 1 (= never) and 5 (= always), with 3 corresponding to the neutral point.

The above results indicate a generally modest use of business analysis techniques. The only exception to this pattern is the use of sales estimates with the higher mean value (Mean = 3.83) and the lower standard deviation (SD = .93). Contrary to the relevance of sales estimates, the other business analysis indicators are not object of regular utilization by participating firms.

5.2.7. Market testing

The use of three market testing approaches was assessed with two 5-point Likert type scales, ranging from 1 (= never) to 5 (= always). Table A3.8 presents the descriptive statistics for market testing items.

The results eloquently describe the irregular use of market testing techniques by participating companies. Mini market tests, being less expensive and less time-consuming, are used more often (Mean = 2.31; SD = 1.27) than full market tests (Mean = 1.58; SD = .74). However, none of these techniques seems to be part of the current set of organizational practices for developing product innovations. These results, illustrating limited use of market research in the new product development process, are congruent with previous descriptions of product innovation practices by financial organizations (Reidenbach & Moak, 1986).

5.2.8. Ad hoc designs

The relative use of the ad hoc processes is illustrated in Table A3.9. As in the other cases, the scales ranged between 1 (= never) and 5 (= always).

Ad hoc designs are not frequently utilised by companies participating in the study. In fact, the degree of utilisation of the most frequent ad hoc solution for developing new products – project teams – is not above the neutral point (Mean = 3.24, SD = 1.17). Product innovation committees are even below the neutral point, meaning that they are more the exception than the rule.

5.2.9. Permanent designs

In line with the irregular use of ad hoc designs, companies also make limited use of permanent designs for product innovation. Permanent designs, in this work, refer to organizational structures that incorporate product and new product managers. Companies use more often product managers than new product managers (see Table A3.10). However, the product manager position is only real in a limited number of cases, the average score for the item being 3.01. The scales range between 1 (= never) and 5 (= always), with 3 marking the neutral point.

The under-utilization of new product managers may be penalising for companies given that, as found by Reidebach and Moak (1986), the best performers in retail banking are characterised, among other things, by the existence of new product managers that oversee the whole process of new product development.

5.2.10. Number of product innovations

The mean number of new products launched in the year considered for analysis was 3.93 (SD = 5.18). Table 5.2 presents the frequencies of the number of new products launched by 45 companies.

Table 5.2[6]
Number of product innovations by company

Number	Frequency	Percentage	Cum. Percentage
0	13	27.66	27.66
1	6	12.77	40.43
2	5	10.64	51.07
3	4	8.51	59.58
4	5	10.64	70.22
5	2	4.26	74.48
6	1	2.13	76.61
7	2	4.26	80.87
8	1	2.13	83.00
9	1	2.13	85.13
11	1	2.13	87.26
14	1	2.13	89.39
17	1	2.13	91.52
20	2	4.26	95.78
missing	2		100

Figure 5.1 complements the information presented in Table 5.2 by graphically displaying the number of product innovations by company.

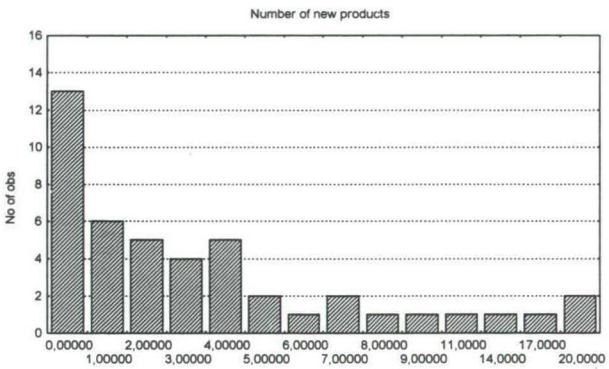

Figure 5.1
Histogram of the number of products innovations by company

As shown by the data, almost one-third (13 companies) of the organizations under analysis, have not launched a single new product during that period, and more than half of the companies launched two products or less. This figure is somewhat surprising as a characterisation of the competitive behaviour of companies operating in an environment usually described as turbulent and highly demanding in terms of product innovation capacity.

[6] In this table, zero number of products means that the company has not launched any new product during the period under scrutiny.

5.2.11. Product innovation newness

On average, companies report the launch of more product improvements than any other type of new products. Means and standard deviations for new product newness are presented in Table 5.3.

Table 5.3
Results of product innovation newness degree

Type Number	New to the world	Improvements	Additions	Cost reductions	Repositionings
0	28	25	27	40	40
1	7	6	6	2	1
2		3	4		1
3	6	2	1	1	1
4	3	2	3	1	1
5		3	2		
6		1			
7		1			
8			1		
9		1			
10					
11					
Total	37	63	47	9	10
Percentage	22.29	37.95	28.31	5.42	6.02
Missing	3	3	3	3	3

Note: Zero new products means that the company has not launched any new product during the period under scrutiny

As displayed in Table 5.3, the product type in which most new products fall is product improvements. This is followed by additions and, surprisingly, by new to the world products (37 new products). Cost reductions and repositionings are the types that represent the lower frequencies of new product innovations.

5.2.12. Product innovation success

The number of new products, by organization, falling in each of five success categories, is presented in Table 5.4.

Table 5.4
Results of product innovation success

Type Number of products	Much lower than expected	Lower than expected	As expected	Better than expected	Much better than expected
0	39	33	25	28	34
1	3	8	7	5	7
2	3	2	3	4	1
3		2	4	3	3
4				1	
5			1		
6			1		
7				1	
8			2	1	
9			1	1	
10			1		
11				1	
Total	9	18	71	61	18
Percentage	5.10	10.17	40.11	34.46	10.17
Missing	2	2	2	2	2

Note: Zero new products means that the company has not launched any new product during the period under scrutiny

Only 9 products launched during the period under analysis are considered to have performed much lower than expected. 18 have had a degree of success lower than expected. Thus, only 15.27% of the new products have not performed as good as expected. In contrast with the previous results, 44.63% performed better than initially expected. These results seem to indicate that, in general, companies considered to have achieved their goals in terms of product innovation success.

5.2.13.Product innovation programme

Five 5-point Likert type items were included, aiming to assess the overall results of the new product programme, with 1 being the lower bound and 5 the upper bound.

Results of the product innovation programme are, on average, close to the neutral point, meaning that they are thought of as neither especially good nor bad. The highest average score (Mean = 3.85; SD = 1.10) refers to programme's impact on sales and profits Table A3.11 presents the statistics for these items. This observation suggests a positive perception of respondents about their company's product innovation programmes. The lower average score was that of the item referring to programme's results compared with competitors' results (Mean = 3.26; SD = .92). Putting these two answers together, it seems possible to conclude that, although having positive consequences, programmes are not as sharp as they should be, compared with competitor programmes.

5.2.14.Descriptive statistics: A general overview

The descriptive statistics presented between sections 5.2.1 and 5.2.12 suggest some remarks that may be helpful for understanding the financial services sector in Portugal, as well as some of the characteristics of the organizations participating in the study. Rather than commenting results with interpretations that flow directly from the data, like the diversity of organizations in terms of size and age, for example, this discussion will try to extract a pattern underlying the descriptive analyses. This interpretation is expected to pave the way for developing a better knowledge of the companies involved in the study and, consequently, for extracting a deeper understanding of the more refined analyses to be presented below.

The analysis of the strategy classifications suggests that organizations tend to view themselves as more proactive than their competitors think they are. When the analysis moves from the self-classification to the external classification, the number of prospectors declines from 12 to 6, while the number of defenders increases from 8 to 18. This discrepancy may be due to, at least, two reasons. On the one hand, organizations may tend to show a proactive bias because of social desirability: given the positive connotation of innovation in contemporary business environments, it may seem socially more appropriate that an organization self-classifies as prospector than as a defender. It should be remembered that the labels for the strategic types were not presented in the questionnaire, but the more proactive character of prospectors was evident throughout the description, as well as the more conservative nature of defenders. Is then possible to hypothesise, although on a speculative basis, that the social desirability bias toward innovation, may pressure companies to overemphasise their willingness and capacity to innovate. Organizations would, consequently, view themselves as more innovative than their competitors think they are. Only two companies that classified themselves as prospectors, are thought to be so by competitors. 14 self-claimed prospectors are classified by their competitors as analysers. Another possible reason accounting for the discrepancy between self and external classifications may be the closure of product innovation information, which not being accessible to competitors, may distort their analysis of organizational innovative capacity.

Another interesting pattern arising from the data refers to the attention that companies seem to pay to competitor moves. More than searching for unmet needs and expectations, they appear to be trying to be aware of competitor's actions. In this context, the main source of market knowledge is knowledge of competitors, not perceptions of product features and quality by customers, or the search of the external information needed to develop new product innovations. In line with this finding, the dissection of competitive products is the most widely used idea generation and screening technique. This competitor-oriented technique is more regularly used than, for example, brainstorming or gap analysis. These two results seem to suggest that new product innovations in the Portuguese

financial sector are, in most cases, more dependent on competitor's moves than on actual knowledge of market needs.

Product innovation, then, would be less a matter of a genuine customer orientation, than an attempt to watch out and respond to competitor moves. Other results seem to provide some support to this position. For example, market tests are not regularly utilised as product innovation tools, which may be viewed as an additional indication of the limited attention that, on average, companies pay to customer-based information. Additionally, if 34 of the companies in the sample have a marketing department, only 18 report the existence of an R&D department. In only two cases, companies have a marketing and an R&D department. The small number of companies in the sample having an R&D department is an interesting observation, in the sense it shows that the importance of the product innovation function is not yet formally and structurally inarguable. The non-existence of product development departments, with all the consequences associated with it, may be one of the reasons why so much companies (13 companies) have not launched a single product in the year under analysis. It is also an expressive finding the fact that zero-products constitutes the mode for the number of new products launched by organizations in the sample.

Despite the previously discussed results, companies, on average, said to be satisfied with the impacts of their product innovation programmes, although recognizing that, compared with competitors' programmes, their results could be improved.

The descriptive results seem to support some general conclusions about the state of the art in terms of product innovation in the Portuguese financial sector: (1) Product innovation efforts seem to be driven more by external competitor pressure than by internal market orientation; (2) The need for formal product innovation management structures has not yet been recognised except by a minority of financial organizations; (3) Notwithstanding the often referred competitive turbulence of the sector, a high number of companies have not launched new products in the period under analysis; (4) Despite the previous observations, companies seem to have a generally positive perception of their orientation to proactive and innovative activities, as expressed by the results of strategic classification, product evaluation, and programme results.

The conclusions reported above show that, to some extent and in line with previous research (e.g. Edgett & Jones, 1991), product innovation may occur by chance in many financial organizations. The relative satisfaction of companies with their product innovation programmes, may thus be due to positively biased evaluations of product innovation capacity. The existence of such a bias has been reported by Drew (1992b).

5.3. TRANSFORMING THE VARIABLES

In order to prepare the structural analysis, and due to the small sample size, a listwise matrix was not the best way to handle missing data points. To overcome this problem, a mean substitution strategy has been used, aiming to restore the full use of cases. Such a strategy does not go without costs (Bollen, 1989), but it is recommended considering that structural equation modeling is prepared to deal with complete data sets (Bentler & Chou, 1987), a demand that is difficult to fulfil in organizational field studies. The necessity to avoid missing values also needs to be explicitly handled when using partial least squares, as Lohmoller's LVPLS (Latent Variable Partial Least Squares) doesn't run with missing values (Hulland, 1995).

5.4. DATA ANALYSIS

Data analysis in this study proceeded in two steps. First, the full model was tested with partial least squares. With this second generation multivariate analysis technique, the model was analysed as a conceptually consistent block, and its theoretical adequacy to empirical data, tested. A first generation multivariate data analysis technique, regression analysis, was subsequently run, in order to make the relationships between the intervening variables more clear. This shift from PLS to multiple regression intended to provide an additional understanding of the specificities of the model. To phrase it differently, data analysis moves from the general to the particular: after testing the adequacy of the whole structural model, some parts of it are analysed in order to make the relationships between specific subparts of the model more clear.

5.4.1. The structural analysis

This section presents the structural equation analysis of the model advanced and discussed in Chapter 3 and graphically displayed in Figure 5.2. Before proceeding with the presentation of the model and considering the limited diffusion of partial least squares, a brief presentation of this technique is provided.

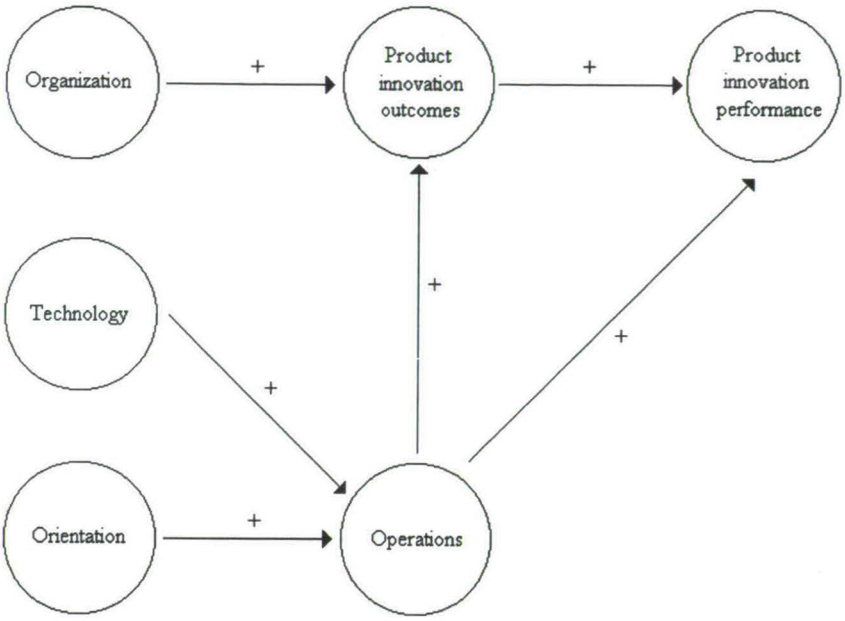

Figure 5.2
The structural model

5.4.1.1. Partial Least Squares (PLS)

The analysis of the research model followed the approach indicated by Fornell and Larcker (1981) for the evaluation of structural equation models, when using the Partial Least Squares algorithm proposed by Lohmoller (1981)[7]. PLS was

[7] A general PLS model consists of two parts: the measurement model (that specifies the relations between the manifest variables and the constructs that they represent), and the structural model (that specifies the relations among the constructs). The structural model writes as : $\beta\eta = \Gamma\xi + \zeta$, where $\eta = (m \times 1)$ is a vector of latent endogenous variables, $\xi = (n \times 1)$ is a vector of exogenous latent variables, $\beta = (m \times m)$ is a matrix of endogenous variable coefficients, $\Gamma = (m \times n)$ is a matrix of exogenous variable coefficients, and $\zeta = (m \times 1)$ is a vector of residuals. The measurement model is written as follows: $y = \Lambda_y\eta + \varepsilon$ and $x = \Lambda_x\xi + \delta$, where $y = (p \times 1)$ is a vector of endogenous indicators, $x = (q \times 1)$ is a vector of exogenous indicators, $\Lambda_y = (p \times m)$ is a matrix of regression coefficients of η on y, $\Lambda_x = (q \times n)$ is a matrix of regression coefficients of ξ on x, and $\varepsilon = (p \times 1)$ and $\delta = (q \times 1)$ are, respectively, the vectors of measurement error for endogenous and exogenous variables. PLS assumes that unobservables are linear combinations of their indicators, and that all variables are standardized. The PLS estimation process runs in two steps: (1) the estimation of latent variables is conducted iteratively, by successive approximations, with alternations between the measurement and structural models; parameters estimates in either part are taken as fixed as parameters in the other part are estimated; (2) upon convergence, measurement and

selected as the adequate structural modeling technique for this study, as it is more appropriate than the well-known LISREL under the following conditions: (1) when sample sizes are small; and (2) when the models under analysis are complex. As this research befits these two conditions, PLS represented the most adequate statistical tool for conducting a full test of the model. PLS, contrary to LISREL, also has the advantage of not implying any assumptions about multivariate normal distributions.

Despite the limited present use of PLS, it seems to be gaining a growing interest from marketing and organizational researchers (Cool, Dierickx & Jemison, 1989; Hulland, 1995; Smith & Barclay, 1997). As argued by Fornell and Cha (1994), PLS should not simply be viewed as an alternative to LISREL with less stringent assumptions, but as a different approach to structural modeling. PLS and LISREL share some similarities but diverge in many ways (extensive discussions of PLS can be found in Wold, 1985 and Fornell & Cha, 1994). Among the similarities, *inter alia*, it can be said that they both pertain to what some authors labelled as the second generation of multivariate analysis (see Wold, 1985), and that they both allow the analysis of path models with latent variables. As any second generation multivariate analysis, both LISREL and PLS provide the following benefits (Hulland et al., 1996): (1) they make the assumptions, the constructs, and the relations involved in a theory explicit; (2) they require clear definitions of constructs, of operationalisations and of functional relationships between constructs; (3) they facilitate comprehensive representations of complex theories, and (4) they favour the construction and testing of both measures and theories.

However, and despite these similarities, the two approaches also show important differences, namely: (1) LISREL assumes multivariate normal and interval scaled data, while PLS follows a distribution free approach for estimating parameters; (2) LISREL recommends the use of large samples when compared with the requirements of samples sizes made by PLS; and (3) PLS allows the handling of more complex models than LISREL, as it does not encounter the difficulties found by LISREL in terms of the identification, convergence and goodness-of-fit, which can result in improper solutions. As noted by Hulland (1995), these observations do not mean that PLS is better than LISREL, but only that its use may be recommended under some specific circumstances not covered by LISREL. As discussed above, the relative complexity of the model under testing, as well the small sample size, discard the use of the LISREL approach. In this work the number of cases, in fact, is below the minimum level taken as adequate in the LISREL literature: samples of 200 or at least 100 are viewed as necessary for applying the LISREL approach (Hulland et al., 1996). Some authors consider that every LISREL model should be tested with 150 cases, as this value constitutes the critical dimension for working with the LISREL algorithm (Hair et al., 1992).

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structural linkages are estimated by ordinary least squares (OLS) regression, using the latent variables estimated in the first step (Cool et al., 1989).

In the case of this work, the sample is constituted by 47 organizations. As previously referred, individual responses were aggregated by average at the organizational level to develop reflective indicators of the constructs in the model. Although the constructs may be interrelated over time, the investigation of how present product innovation development and performance affects future results is beyond the scope of this study. The relationships in the model are, thus, specified as recursive.

5.4.2. Regression analyses

In order to test the relationships between indicators, several regression models were built and tested. Before proceeding with the regression analysis, data have been assessed for multicollinearity. Considering that coefficients of .80 or more in the intercorrelations between independent variables necessarily induce multicollinearity (Bryman & Cramer, 1990), a data check supports the conclusion that the data showed no problems of multicollinearity. Except for the intercorrelations between number of new products and product innovations success, and between product innovation newness and product innovation success, intercorrelations are below the critical value conventioned to signal multicollinearity. As can be seen in Table 5.5, the pairs of variables with intercorrelations superior to .80 do not enter the same regression as predictor variables, which means that there is no need to remove variables to avoid problems of multicollinearity.

According to the goals of this section, it was analysed to what extent the independent variables in the model can be used to predict the dependent variables. The regression analyses deal with the indicators, instead of the constructs, and each indicator for each endogenous construct will be considered as the criterion variable in a regression model. In order to do so, the twenty seven regression models presented in Table 5.5 were elaborated and tested. The order of presentation of these models is organized in function of the dependent variable. Every model in which a given variable is taken as the criterion variable, is presented under the same subsection, in order to make its relationships with the antecedent variables more clear.

Table 5.5
A summary of regression models

Model	Regressed variable	Regressor variable(s)
1.1	Number of product innovations	Age, size
1.2	Number of product innovations	Idea generation and screening, ad hoc designs, permanent designs, business analysis, market testing
1.3	Number of product innovations	Age, size, idea generation and screening, ad hoc designs, permanent designs, business analysis, market testing
2.1	Product innovations newness	Age, size
2.2	Product innovations newness	Idea generation and screening, ad hoc designs, permanent designs, business analysis, market testing
2.3	Product innovations newness	Age, size, idea generation and screening, ad hoc designs, permanent designs, business analysis, market testing
3.1	Idea generation and screening	Technology
3.2	Idea generation and screening	Market knowledge, product evaluation, proaction, product diversity
3.3	Idea generation and screening	Technology, market knowledge, product evaluation, proaction, product diversity
4.1	Business analysis	Technology
4.2	Business analysis	Market knowledge, product evaluation, proaction, product diversity
4.3	Business analysis	Technology, market knowledge, product evaluation, proaction, product diversity
5.1.	Market testing	Technology
5.2	Market testing	Market knowledge, product evaluation, proaction, product diversity
5.3	Market testing	Technology, market knowledge, product evaluation, proaction, product diversity
6.1	Ad hoc designs	Technology
6.2	Ad hoc designs	Market knowledge, product evaluation, proaction, product diversity
6.3	Ad hoc designs	Technology, market knowledge, product evaluation, proaction, product diversity
7.1	Permanent designs	Technology
7.2	Permanent designs	Market knowledge, product evaluation, proaction, product diversity
7.3	Permanent designs	Technology, market knowledge, product evaluation, proaction, product diversity
8.1	Product innovations success	Idea generation and screening, ad hoc designs, permanent designs, business analysis, market testing
8.2	Product innovations success	Number of product innovations, product innovations newness
8.3	Product innovations success	Idea generation and screening, ad hoc designs, permanent designs, business analysis, market testing, number of product innovations, product innovations newness
9.1	Product innovation programme	Idea generation and screening, ad hoc designs, permanent designs, business analysis, market testing, number of product innovations, product innovations newness
9.2	Product innovation programme	Number of product innovations, product innovations newness
9.3	Product innovation programme	Idea generation and screening, ad hoc designs, permanent designs, business analysis, market testing, number of product innovations, product innovations newness

5.5. RESULTS

Section 5.5 presents and discusses the empirical results obtained in this study. The section is organized around two main subsections: in subsection 5.5.1, the structural equation analysis using PLS is presented and discussed; in subsection 5.5.2, the presentation moves to the regression analyses. After their presentation, the results for the PLS model as well as for the regression analyses are discussed.

5.5.1. Model testing with PLS

In this section, the results of the PLS analysis are presented and discussed. PLS was selected based on the reasons discussed under section 5.4.1.1., and because its objective is the explanation of variance, a goal that is accomplished by using ordinary least squares (Green, Barclay & Ryans, 1995). As the goal of this study consisted in the maximisation of the prediction of product innovation performance, PLS seems to constitute an appropriate approach for handling data. In PLS, measurement and structural parameters are estimated together. Their interpretation, however, occurs in two stages. First, the measurement properties are analysed. Then, and if the measurement results could be considered generally acceptable, the structural model is analysed. The presentation starts with the measurement (outer) model and then proceeds to the structural (inner) model.

5.5.1.1. Measurement model

As expected after having conducted the preliminary analysis presented and discussed in Chapter 4, PLS overall measurement results can be considered strong. Table 5.6 presents weights, factor loadings, and the average variance extracted. In order to assess the significance levels for path coefficients and item loadings, the jackknifing technique (Fenwick, 1979) was used. As pointed out by Fenwick (1979), the jackknife makes it possible to evaluate the stability and significance of results without the requirements of large sample sizes. The jackknifing technique, is concisely described by Huff (1993: 1) as a 'technique in which a series of different subsamples (or partitions) are formed from a total data set, by omitting a few cases each time. The PLS procedure is executed against each partition, and the resulting distribution of the path and loading coefficients is used to determine t-scores, standard errors, etc.' It is, then, a data-oriented technique that measures the accuracy of parameter estimates (Fornell & Barclay, 1993).

Table 5.6 shows the overall measurement model that employs sixteen indicators for the three exogenous and three endogenous constructs, indicated in the Figure 5.2 path diagram. As shown in Table 5.6, the indicators have large and significant loadings on their posited constructs.

Table 5.6
Measurement results

Construct/Measures	Weights[a]	Loadings[d]	AVE[e]
Organization			.68
Size	2.91	.99	
Age	.11[b]	.62	
Technology			1.00[c]
Technology	1.00[c]	1.00[c]	
Orientation			.55
Knowledge	.43	.81	
Product evaluation	.40	.86	
Proaction	.28	.74	
Assortment	.25	.47	
Operations			.59
Idea generation and screening	.33	.89	
Business analysis	.26	.85	
Market testing	.20	.73	
Ad hoc designs	.32	.76	
Permanent designs	.19	.56	
Product innovation outcomes			.98
Number	.51	.99	
Newness	.50	.99	
Product innovation performance			.64
Success	.85	.95	
Programme	.33	.61	

a) all weights significant at $p<.001$, except where indicated
b) significant at $p<.05$
c) 1.00 is by definition, because only one measure was included for this construct
d) all loadings significant at the $p<.001$ level
e) AVE = average variance extracted

Through jackknifing, it was possible to conclude that the weights and loadings for outer model are significant at the $p<.001$ level of analysis. The single exception is the weight of age on the organization construct, which is significant at the $p<.05$ level. The average variances extracted in constructs are all above .50, which confirms the existence of convergent validity.

As referred by Fornell and Larcker (1981), and by Green et al. (1995), if the average variance extracted is greater than the variance shared between a construct and other constructs in the model, there is adequate discriminant validity. The correlation matrix for the constructs in the model is shown in Table 5.7. In general terms, the model can be said to show adequate discriminant validity, as diagonal elements are greater than off-diagonal elements in corresponding rows and columns.

As a second criterion for assessing discriminant validity, no item should load higher on another construct than in the construct it was expected to measure. The examination of cross-loadings shows that all items but one passed this test. The single exception is product innovation outcomes and product innovation performance. This can be an issue, due to the fact that the two constructs may not be conceptually as distinct as desirable. These two constructs thus need further

development. The constructs were kept in the model because: (1) in all other respects they appeared strong (loadings all above .60, satisfactory convergent validity); and (2) they are important to the theoretical meaning of the model, which is an important criteria when using structural equation modeling.

Table 5.7
Correlations between constructs

Construct	1	2	3	4	5	6
1. Organization	**.83**					
2. Technology	-.17	**1.00**				
3. Orientation	.01	.57	**.74**			
4. Operations	-.01	.53	.67	**.77**		
5. Outcomes	.37	.10	.25	.25	**.99**	
6. Performance	.31	.24	.35	.34	.93	**.80**

Note: diagonal is square root of average variance extracted

Overall, and despite the problem of discriminant validity described above, it can be concluded that measurement results are acceptable. It is then appropriate to analyse the structural model.

5.5.1.2. Structural model

As referred above, PLS does not provide any summary statistic to evaluate overall model fit. However, the variance explained and the significance of path coefficients may be used to assess the validity of a model. As shown by Table 5.8, all path coefficients are significant at the $p<.001$ level. They all run in the theoretically hypothesised directions, thus supporting the proposed model[8].

Table 5.8
Structural results

Linkages in the model	Path coefficients: Direct effects	t-value[a]
Organization→outcomes	.37	8.77
Technology→operations	.21	7.85
Orientation→operations	.55	18.74
Operations→outcomes	.25	11.69
Operations→performance	.12	11.17
Outcomes→performance	.90	150.14

[a] all paths significant at $p<0.001$

[8] Some theoretically meaningful competing models, were also tested, but proved to be less fitted to the data than the model discussed here. For an overview of competing models, see Appendix 4.

The statistical significance of the path coefficients, and the fact that they run in the expected theoretical directions, suggests that the model exhibits nomological validity. In fact, the fit of the structural model should be evaluated by the incidence of significant proposed relationships among the constructs. Thus, the PLS structural results basically confirm the role of organization, technology, and orientation as powerful determinants of how companies develop new products as well as of the results they achieve. Consistent with the hypothesised model (see Propositions P_1 to P_6, section 3.3.4), the following paths proved to be statistically significant: organization influences product innovation outcomes (which is consistent with P_1); technology has an impact on product development operations (P_2); orientation impacts product development operations (P_3); operations influence the product innovation outcomes (P_4); operations influence product innovation performance (P_5), and product innovation outcomes influence product innovation performance (P_6).

The results also show that more diverse and sophisticated operations for new product development are more dependent on the organization's orientation than on the sophistication of available technologies. Additionally, it can be concluded that superior product innovation performance appears to be more dependent on the number and newness of the new products launched by the company, than on the sophistication of development techniques, although these also proved to have a strong positive impact on performance.

As pointed out by Cool et al. (1989), researchers, when interpreting structural models, should consider not only direct, but also indirect and total effects. Table 5.9 indicates the direct, indirect, and total effects of every construct in the model on product innovation performance.

Table 5.9
Determinants of product innovation performance[a]

Antecedent construct	Direct effects	Indirect effects	Total effects
Organization	0.0	.33	.33
Technology	0.0	.03	.03
Orientation	0.0	.07	.07
Operations	.12	.23	.35
Outcomes	.90	–	.90

[a] R^2 (with product innovation performance as the dependent construct) = .87.

An important observation based on Table 5.9, is that none of the linkages changed its sign. Thus, despite changes in terms of absolute size, the established relationships among the constructs hold still. Nevertheless, some changes in magnitude of relations are interesting and should be discussed.

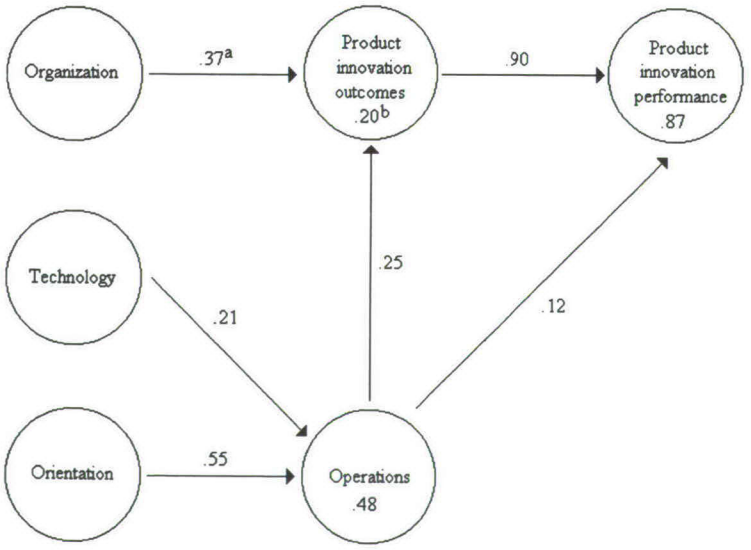
Predictors of product innovation performance explain 87% of the variance in the construct. Product innovation outcomes were found to be a very strong predictor of product innovation performance (β = .90). This very strong impact indicates

that the number and newness degree of product innovations are the most valued attributes of product innovation in organizations. Ultimately, the higher the number and newness of product innovations, the better a company's product innovation performance. The number and newness of new products are then the most important determinants of an organization's product innovation performance.

Product innovation operations proved to have a more substantial indirect than a direct impact on product innovation performance (with betas of, respectively, .12 and .23). It is important to note the magnitude of the indirect effect of operations on product innovation performance (.23), which is stronger than the direct effect. The total effect of operations on performance is of .35 which is only slightly superior to the indirect effects exhibited by organization factors (β = .33). The strong positive effect of organization on product innovation performance supports the central contention of this work: that product innovation is an organizational activity that should be studied in context, and not as an isolated process.

The technology and orientation constructs, although important for explaining how the organizational context impacts product innovation performance, show negligible or modest indirect effects on product innovation performance (only β = .03 and β =. 07, respectively). Thus, technology and orientation appear to be important in shaping the operations for new product innovation, but not as determinants of product innovation performance.

Graphically, the structural results can be presented as in Figure 5.3.



*Path coefficients; all relationships supported (p<.001)
**R^2

Figure 5.3
Structural model summary

The results of the structural model presented above provide a set of relevant implications for understanding product innovation in organizations. The implications for scholarship and for management will be discussed in Chapter 6. As suggested in the structural equation literature, several competing models were tested. These models, that proved to be less satisfactory than that presented and discussed in this chapter, are displayed in Appendix 4.

5.5.2. Regression analyses

Having analysed and confirmed the adequacy of the full model with partial least squares, the work will now proceed with the presentation of the results of regression models presented in Table 5.5. These regression analyses are intended to capture the relationships involved in specific subparts of the general model discussed before. They aim, therefore, to analyse what independent variables show a stronger impact on what dependent variables. Regression analyses, thus, serve as a complement, not as an alternative to the structural analysis presented and tested before. The organizing structure for subsection 5.5.2. is as follows: firstly, we will analyse every model having the same criterion variable will be analysed; then, after the individual analyses and discussion of each regression model, the conclusions for the group of models will be outlined and discussed. A general overview of regression results is presented in Table 5.10.

Table 5.10
An overview of regression results

Regressed	Regressors (model)
Number of product innovations	Organizational size (1.1) No regressors extracted (1.2) Organizational size + idea generation and screening (1.3)
Product innovations newness	Organizational size (2.1) Idea generation and screening (2.2) Organizational size + idea generation and screening (2.3)
Idea generation and screening	Technology (3.1) Market knowledge (3.2) Technology + market knowledge (3.3)
Business analysis	Technology (4.1) Product evaluation (4.2) Technology + product evaluation – proaction (4.3)
Market testing	Technology (5.1) Market knowledge (5.2) Technology + market knowledge (5.3)
Ad hoc designs	Technology (6.1) Market knowledge + proaction (6.2) Technology + market knowledge (6.3)
Permanent designs	No regressors extracted (7.1) Market knowledge (7.2) Market knowledge (7.3)
Product innovations success	Idea generation and screening (8.1) Number of product innovations (8.2) Number of product innovations + ad hoc designs (8.3)
Programme success	Ad hoc designs (9.1) Number of product innovations (9.2) Ad hoc designs + number of product innovations (9.3)

5.5.2.1. Number of product innovations as criterion variable

This section presents three regression models that have in common the fact of taking the number of product innovations as the criterion variable. In the first regression (model 1.1), the indicators for the organization construct (size and age), are the independent variables. Model 1.2 considers the operations indicators (ad hoc designs, permanent designs, idea generation and screening, business analysis and market testing) as the predictors. Model 1.3 puts the organization and operations constructs together in a single and more inclusive model.

Regression model 1.1

The first regression model takes the number of new product innovations as the dependent variable. Two independent variables are considered: size and age. Using the stepwise estimation, was intended to examine the contribution of each independent variable to the regression model.

The results allowed to conclude that size is a significant predictor of the number of new product innovations ($\beta = .40$, $p<.01$). The variance explained by this model is of $R^2 = .16$.

This regression model shows that size can be viewed as a significant predictor of the number of product innovations launched by a company. This finding is in line with the hypothesis that large organizations may have differential advantages when it comes to product innovation. Such a result has, at least, two implications: (1) firstly, it confirms the impact of organizational size on product innovation; and secondly (2) it supports the hypothesis that size has a positive effect on product innovation, not a negative effect. By having comparatively abundant resource pools, including slack, more specialists, and advantages of resource allocation in the marketplace, large organizations may have the means to develop and launch more product innovations.

Regression model 1.2

Regression model 1.2 considered the number of product innovations as the criterion variable, and the product innovation operations indicators (idea generation and screening, ad hoc designs, permanent designs, business analysis and market testing) as the predictor variables.

None of the product innovation operations emerged as a significant predictor of the firm's number of product innovations.

Regression model 1.3

Model 1.3 puts all organization and operations variables as regressors and the number of product innovations as the regressed variable. Such a model accounted for 23% of the variance. Two variables, organizational size ($\beta = .39$, $p< .005$) and idea generation and screening ($\beta = .27$, $p<.05$) proved to be significant predictors.

Thus, organizational size and idea generation and screening techniques appear as the best predictors of the number of new products launched by the companies participating in the study. As a possible explanation for these results, the following arguments can be advanced: on the one hand, organizational size may have several advantages for developing new products; on the other hand, idea generation and screening techniques may act as a stimulus for developing more new products as they uncover opportunities to explore and gaps to fill with product innovations. The above results seem to notice the competitive advantages achieved by companies able to combine the advantages of being large with the benefits of proficiency in the management of idea generation, materialised in the adoption of techniques that facilitate a better search of product innovation opportunities.

Conclusions of regression models 1.1 to 1.3

Regression models 1.1 to 1.3 (for a summary, see Table 5.11) show that organizational size works as the best predictor of the number of new product innovations launched by a company. Considered in isolation, none of the product innovation operations indicators emerged as a significant predictor of the number of new products launched by a company. In the model that puts together the organization and operations indicators, it is important to note that idea generation and screening techniques emerged as a second significant predictor, although with a smaller impact than that of organizational size.

Table 5. 11
A summary of regression results: Models 1.1, 1.2, and 1.3
Regressed variable: Number of product innovations

	Model 1.1	Model 1.2	Model 1.3
Age (β)			
Size (β)	.40		.39
Adhoc (β)			
Permanent (β)			
Idea (β)			.27
Business (β)			
Testing (β)			
R^2	.16		.23
AdjR^2	.14		.20
F-Value	8.73**	n.s.	6.69**

*p<.05, ** p<.01, ***p<.001.
n.s. = not significant
Note: shaded cells refer to variables not considered for the model; clear cells refer to variables not included in the model.

These results seem to illustrate that organizational size may not work as a barrier to innovation but, at least in this sample, as a facilitator. Large organizations may have the conditions to assign more professionals, to devote more resources, and to spend more time in activities of environmental scanning and process development. These factors may, in turn, facilitate the launch of a superior

number of new products compared with smaller competitors. Idea generation and screening can also be viewed as a predictor of the number of product innovations, although this significance did not emerge in the regression model which didn't include organizational indicators. The conclusions of regression models 1.1, 1.2 and 1.3 seem to demonstrate: (1) that size is the best predictor of the number of new product innovations; and (2) that the use of idea screening and generation techniques can also be thought of as a predictor of the number of new products launched by a company, when in interaction with size. Putting these conclusions together, it seems that large organizations, especially those emphasising the use of techniques for idea generation and screening, are best positioned to launch a higher number of new products. Thus, companies combining the advantages of size with keeping a sense of 'curiosity' seem to be the more innovative of all.

5.5.2.2. Product innovation newness as criterion variable

Section 5.5.2.2. presents the regression equations that take product innovation newness as the regressed variable. Regression model 2.1 considers the indicators age and size as regressors. Model 2.2 considers the operations indicators (idea generation and screening, business analysis, market testing, permanent designs and ad hoc designs) as the predictors. Regression model 2.3 puts the organization and operations indicators together in a single model.

Regression model 2.1

Regression model 2.1 treated product innovation newness as the criterion variable and considered the two organization indicators, age and size, as the predictors.

Using multiple regression with these variables, an explained variance of R^2 of .14 was found. Size emerged as a statistically significant antecedent (β = .37, $p<.001$).

These results show that larger firms tend to develop product innovations with a higher newness degree than do smaller firms. Such a conclusion illustrates, once again, the advantages of size for product innovation. By showing that new products with higher degrees of newness tend to arise in large organizations, the previous evidence indicates that large organizations may have the means to develop product innovations with a higher newness degree, which may not be easily accessible to smaller firms. These results also allow to conclude that the so called bureaucratic syndrome may be circumvented by large companies, which appear to be developing and launching more innovative products than their smaller competitors.

Regression model 2.2

Regression model 2.2 considered product innovation newness as the dependent variable, and idea generation and screening, business analysis, market testing, ad hoc designs, and permanent designs as the predictors. Idea generation and screening emerged, from among the independent variables, as the one that

significantly predicted product innovations newness (β = .31, $p<.05$). Idea generation and screening explained 10% of the variance of the regressed variable.

This result is far from surprising, as it shows a significant association between the management of ideas for new products and the degree of product innovation newness. The relationship between these variables may be due to the fact that those organizations that make more use of idea generation and screening techniques, may be best positioned to be more innovative. In fact, organizations that make more regular use of forecasting, brainstorming, gap analysis, dissection of competitive products, and that filter ideas for new products according to the company's product policy and develop check lists for product screening, may have a better knowledge of what product innovativeness with a high newness degree is all about. In contrast, firms making less use of these techniques may have less developed skills in what refers to departing from more routine and, comparatively, less innovative new products, as they lack the sources for generating product innovations with high newness degrees.

Regression model 2.3

Using multiple regression with all indicators from the organization and operations constructs serving as predictors and product innovation newness serving as criterion variable, an R^2 = .29 was found. Two variables emerged as statistically significant predictors of the criterion variable: organizational size (β = .36, $p<.001$) and idea generation and screening (β = .30, $p<.05$).

These findings run partially against the prevailing theorisation in marketing and organization theory, in the sense that large organizations tend to be considered more resistant to innovation than smaller ones. However, in this study, size worked as the best predictor of a firm's newness degree of product innovations. Although contrary to the dominant perspective, this result is not difficult to explain: large organizations may constitute more favourable environments to nurture those innovations that, given their high degree of newness, may demand more resources (including people, technologies, time, and money) to develop and launch. It is interesting to notice that the other significant predictor of product innovation newness, is the degree of utilization of idea generation and screening techniques. This may mean that size is a facilitator of product innovation newness when the organization is genuinely interested in developing product innovations with high degrees of newness. Organizations with the conditions (arising from size) and the willingness (operationalised in the degree of utilization of techniques for searching and screening ideas for new products) to develop the most innovative products, may more easily beat their counterparts in monitoring the market in search of ideas for innovation.

Conclusions of regression models 2.1 to 2.3

Regression models 2.1, 2.2 and 2.3, putting product innovation newness as the criterion variable, show that there are two statistically significant predictors of

new product newness: organizational size, and idea generation and screening techniques (see Table 5.12).

Table 5. 12
A summary of regression results: Models 2.1, 2.2, and 2.3
Regressed variable: Product innovation newness

	Model 2.1	Model 2.2	Model 2.3
Age (β)			
Size (β)	.37		.36
Adhoc (β)			
Permanent (β)			
Idea (β)		.32	.30
Business (β)			
Testing (β)			
R^2	.14	.10	.23
Adj.R^2	.12	.08	.19
F-Value	7.31**	4.81*	6.52**

*p<.05, ** p<.01, ***p<.001.
Note: shaded cells refer to variables not considered for the model; clear cells refer to variables not included in the model.

The emergence of organizational size as a predictor of product innovation newness shows that large organizations may have the best conditions to launch the most innovative new products. The arguments previously used for explaining the influence of size on the number of product innovations may be invoked to explain the results of models 2.1 to 2.3: large organizations that have the willingness to search for the best product innovation ideas, may be those whose new products show the higher levels of newness. To phrase it differently, the organizations that have the best, more sophisticated, environmental scanning processes, may have the best potential to find the most innovative opportunities. If they have the means to translate these opportunities into new products, then they will appear as the most innovative.

5.5.2.3. Idea generation and screening as criterion variable

Under this section, all the regression models having idea generation and screening as the regressed variable will be analysed. The first model (3.1), analysed with simple regression analysis, takes technology as the independent variable. Model 3.2 puts the orientation variables as the predictors. The last model (3.3) in this section considers technology and the indicators of the orientation construct as predictors of idea generation and screening.

Regression model 3.1
Using simple regression with idea generation and screening techniques as the dependent variable, and technology as the independent variable, an $R^2 = .27$ was found. Technology, thus, appeared as a significant predictor of idea generation and screening ($\beta = .52$, $p<.001$).

This regression shows that the organizational degree of technological sophistication has a significant impact on the use of idea generation and screening techniques. Such a facilitating role of technology is possibly due to the fact that technology may provide the means for implementing and making better use of idea generation and screening techniques. In fact, a full utilization of some of these techniques may be demanding in technological terms, which explains why technology works as their best predictor. The impact of technology (especially computers) on forecasting, for example, is widely acknowledged.

Regression model 3.2

Using multiple regression with orientation indicators serving as predictors, and idea generation and screening as criterion, an $R^2 = .48$ was obtained. Market knowledge emerged as a statistically significant predictor of idea generation and screening ($\beta = .48$, $p<.001$).

Thus, the degree of utilization of idea generation and screening techniques, appears to be dependent on the firm's degree of market knowledge. Or, to put it differently, firms with higher levels of market knowledge tend to be those that make more use of techniques for idea generation and screening.

Higher levels of market knowledge, alerting firms to the importance of translating information collected from the marketplace into new products, seems to make more evident the necessity of using sophisticated techniques for addressing the idea management process. Market knowledge, with its emphasis on product development based on outside information, stresses the need for the utilization of techniques able to match organizational requirements for importing external information. Idea generation and screening techniques may be particularly suited to help the company in the task of signalling new opportunities for product introductions and thus are a privileged way of satisfying the organizational requirements of market knowledge.

Regression model 3.3

Regression model 3.3 viewed idea generation and screening as predicted by technology, market knowledge, product evaluation, proaction and product assortment. Two variables emerged as significant predictors of idea generation and screening, namely technology ($\beta = .40$, $p<.01$) and market knowledge ($\beta = .32$, $p<.05$). Together, they explain 36 % of the variance of the regressed construct.

Then, technology and market knowledge affect the degree of utilization of idea generation and screening techniques. These effects may be explained in several ways. On the one hand, technological sophistication may provide the means for being more alert to ideas for developing new products. Market knowledge, on the other hand, stressing the importance of having constantly renewed information about customers and competitors, may reinforce the importance of implementing

adequate management tools for converting the collected information into new products. It may also work as a drive for implementing rigorous idea generation and screening techniques, as the importance of highly innovative new products tends to be more clearly perceived by companies with more sophisticated means for improving market knowledge. These companies may also acknowledge the existence of a relationship between idea generation and screening and the degree of product innovation newness. This relationship, as discussed, has been empirically confirmed in this work (see models 2.2 and 2.3).

Conclusions of regression models 3.1 to 3.3

The use of idea generation and screening techniques is best predicted by the firm's degree of technological sophistication, and by the organizational degree of market knowledge (see Table 2.13).

Table 5. 13
A summary of regression results: Models 3.1, 3.2, and 3.3
Regressed variable: Idea generation and screening

	Model 3.1	Model 3.2	Model 3.3
Technology (β)	.52		.39
Knowledge (β)		.48	.32
Evaluation (β)			
Proaction (β)			
Assortment (β)			
R^2	.27	.23	.36
AdjR^2	.26	.22	.33
F-Value	16.90***	13.62***	12.02***

*p<.05, ** p<.01, ***p<.001.

Note: shaded cells refer to variables not considered for the model; clear cells refer to variables not included in the model.

Technology emerged as the best predictor of the organizational utilization of idea generation and screening. This may be due to several possibilities: (1) organizations with higher levels of technological sophistication may be more willing to invest in an active process of search for new product ideas; (2) the existence of appropriate technologies may be expected to facilitate the implementation of idea generation and screening techniques, some of which may require significant information processing capacities (e.g. forecasting).

Market knowledge does also appear as a predictor of idea generation and screening. This influence is probably the result of the importance attached by firms with high levels of market knowledge, to techniques that favour the collection and interpretation of information concerning market opportunities and threats. These organizations may be more aware of the need for implementing tools to identify and screen ideas, as these techniques act as sources of information and filtering mechanisms that help the company in the identification of ideas deserving to be worked out and developed.

5.5.2.4. Business analysis as criterion variable

Models 4.1 to 4.3 are those that take business analysis as the criterion. In the case of the first model, analysed with simple regression, technology enters as the predictor. Model 4.2 uses the orientation indicators as the predictor variables. Model 4.3 takes as indicators all the independent variables on models 4.1 and 4.2.

Regression model 4.1

Simple regression analysis has been used to test if technology has a significant effect as a predictor of business analysis. The results confirmed this hypothesis ($\beta = .44$, $p<.005$), with an $R^2 = .19$.

This result may be due to the impact of the information processing capacities provided by sophisticated technologies. In fact, the business estimates included in the business analysis methods can be more easily handled and processed if the firm's technological capacity facilitates this accomplishment. Then, technology may be thought of as a facilitator and a stimulus for the implementation of business analysis techniques.

Regression model 4.2

Using multiple regression with all orientation indicators as predictor variables and business analysis as the criterion variable, an $R^2 = .34$ was obtained. Product evaluation appeared as a significant independent variable ($\beta = .58$, $p<.000$).

Thus, product evaluation affects the use of business analysis. This relationship may be a consequence of the fact that firms competing on the basis of customer orientation, product superiority and product differentiation, may be more aware of the need to assess the quality of products in rigorous business terms. The instruments of business analysis may provide a means for assessing the actual superiority of intended product innovations. Products perceived as superior by customers may be expected to provide higher returns. These expectations can be evaluated in terms of business figures which, in turn, may provide the information necessary to confirm to what extent product superiority and the firm's customer orientation are actually being perceived by the market.

Regression model 4.3

Using multiple regression with technology plus all orientation variables as predictors, and business analysis as criterion, an $R^2 = .49$ was found. Three variables appeared as statistically significant predictors of business analysis: technology ($\beta = .38$, $p<.01$), product evaluation ($\beta = .66$, $p<.000$), and proaction ($\beta = .-34$, $p<.05$).

These results suggest that the use of business analysis techniques tends to occur under the following conditions: (1) when more sophisticated technologies are in place; (2) when a search of better mechanisms for the evaluation of new products is pursued by the organization, and (3) when the company adopts a less proactive

stance. An explanation for the impact of these variables on business analyses, should take these several factors into account. The referred factors could include the following: sophisticated information technologies may facilitate the implementation of rigorous instruments for conducting business analysis; rigour in product evaluation may imply a corresponding search for rigour in predictions of the business impacts of product innovations, in order to assess to what extent product superiority could be confirmed in the marketplace. Although unexpected in a first look, the negative relationship between proactive behaviour and the utilization of business analysis techniques appears as understandable. The execution of detailed business analysis may run against proaction: when a company is aiming to put its products in the marketplace before competitors, it seems difficult for it to make use of detailed risk analysis. That is why proactive organizations are especially vulnerable to the risk of sinking the boat (see section 2.3.2.2). Then, there seems to be a trade-off between the risks of missing and sinking the boat. Proactive companies, trying to take advantage of speed, are more willing to take the risks of sinking the boat and less seduced by the potential benefits of detailed business analysis.

Conclusions of regression models 4.1 to 4.3

Regression models 4.1, 4.2, and 4.3, indicate which the best predictors of business analysis are (see Table 5.14).

Table 5. 14
A summary of regression results: Models 4.1, 4.2, and 4.3
Regressed variable: Business analysis

	Model 4.1	Model 4.2	Model 4.3
Technology (β)	.44		.38
Knowledge (β)			
Evaluation (β)		.58	.66
Proaction (β)			-.34
Assortment (β)			
R^2	.19	.34	.49
Adj. R^2	.17	.32	.46
F-Value	10.68**	22.94***	13.24***

*p<.05, ** p<.01, ***p<.001.

Note: shaded cells refer to variables not considered for the model; clear cells refer to variables not included in the model.

Regression 4.1 illustrates the importance of technology. The impact of technology on the use of business analysis techniques, may be explained by the fact that sophisticated technologies facilitate the collection and analysis of the information required for business analysis purposes. Regression 4.2 presents product evaluation as a significant predictor of the regressed variable. Such an influence may result from the fact that companies competing on the basis of product superiority and differentiation put more stress on the use of business analysis techniques. Regression 4.3, including technology and orientation variables as predictors, showed the emergence of a third predictor: proaction,

with more proactive companies exhibiting a lower tendency to use business analysis techniques. Of those predictors, the strongest influence is that of product evaluation, which shows that companies that attach more importance to launching superior and differentiated products, appear to be trying to assess product superiority in business and financial terms.

5.5.2.5. Market testing as criterion variable

Market testing is the dependent variable of models 5.1 to 5.3. The single predictor for the simple regression model labelled 5.1 is technology. The predictors in model 5.2 are the four indicators of orientation (market knowledge, product evaluation, proaction, and product diversity). These same indicators plus technology, enter regression model 5.3 as the predictor variables.

Regression model 5.1
In order to analyse if technology works as a significant predictor of market testing, a simple regression model was built, taking market testing as the criterion variable, and technology as the predictor. The results of this simple regression show that technology is not a statistically significant predictor of the organizational use of market testing.

Regression model 5.2
Using multiple regression with all orientation constructs as the independent variables, and market testing as the dependent variable, an $R^2 = .30$ was found. Market knowledge appeared as a significant predictor of market testing ($\beta = .55$, $p<.001$).

The impact of market knowledge on market testing is an expectable finding. In fact, when a company intends to acquire comprehensive and reliable information about the market, it may decide to make regular use of market testing techniques. Market tests provide important information about market reactions to new products and thus tends to be more utilised when companies exhibit high degrees of market orientation. Less market-oriented companies, in turn, attaching less importance to a deep knowledge of the market, appear to be less receptive to the potential benefits of conducting market tests.

Regression model 5.3
Using multiple regression with technology, market knowledge, product evaluation, proaction, and product assortment as predictors, and market testing as the criterion variable, an $R^2 = .33$ was found. The single variable that emerged as a statistically significant predictor of market testing is market knowledge ($\beta = .57$, $p<.000$).

These results show that companies with deeper market knowledge, are those that make more use of market testing. Companies that give more value to market knowledge are possibly more aware of the need to collect information about the

reaction of customers to new products. In a theoretical sense, the direction of causality among these variables could be reversed, as market testing may constitute a relevant means for the acquisition of market knowledge. Thus, it looks possible to suggest that organizations paying more attention to market knowledge are more willing to conduct market tests, and that market tests, in turn, refine their market knowledge and increase the perceived necessity to acquire more market information. Such a self-reinforcing relationship between market knowledge and market testing is an interesting possibility, that deserves to be analysed in future research.

Conclusions of regression models 5.1 to 5.3

Taking market testing as the dependent variable, regression models 5.1, 5.2, and 5.3 illustrated the impact of market orientation as predictor of the referred criterion (see Table 5.15).

Table 5. 15
A summary of regression results: Models 5.1, 5.2, and 5.3
Regressed variable: Market testing

	Model 5.1	Model 5.2	Model 5.3
Technology (β)			
Knowledge (β)		.55	.57
Evaluation (β)			
Proaction (β)			
Assortment (β)			
R^2		.30	.33
Adj. R^2		.29	.31
F-Value	n.s.	16.90***	20.29***

*p<.05, ** p<.01, ***p<.001.
n.s. = not significant
Note: shaded cells refer to variables not considered for the model; clear cells refer to variables not included in the model.

The use of market tests seems, therefore, to depend on the degree of market knowledge of the firm. Firms with high degrees of market knowledge seem to attach more importance to conducting market tests. This effect appears to be theoretically meaningful, as market tests may be considered important tools for improving an organization's degree of market knowledge. Technology didn't prove to be an important predictor of market testing, neither in isolation, nor in a regression model including all orientation variables.

5.5.2.6. Ad hoc designs as criterion variable

Ad hoc designs is the dependent variable in the regression models to be tested in this section. Model 6.1 takes technology as the independent variable. The indicators for the orientation construct are the predictors in regression model 6.2. Technology and the orientation indicators serve as the predictors in regression model 6.3.

Regression model 6.1
Using simple regression with ad hoc designs as the dependent variable and technology as the independent variable, it was obtained an $R^2 = .32$. Technology proved to be significantly associated with ad hoc designs ($\beta = .56$, $p<.000$).

This result illustrates the impact of technology on the adoption of ad hoc designs for product innovation. This is not surprising, taking into account that a growing body of literature is illustrating the impact of technology (and particularly of information technology) on group processes such as those included under the ad hoc designs label. This result, then, seems to indicate that technological sophistication may act as a facilitator of the utilization of ad hoc designs, which, for their very nature, may require additional coordination efforts, that tend to discourage its use in less technologically advanced organizational settings.

Regression model 6.2
Using multiple regression with all the orientation indicators as predictors, and ad hoc designs as the dependent variable, an $R^2 = .40$ was obtained. Market knowledge ($\beta = .44$, $p<.01$) and proaction ($\beta = .33$, $p<.01$) proved to be statistically significant predictors of the criterion variable.

Market knowledge may require more use of ad hoc designs, in the sense it makes the organization more sensitive and more permeable to opportunities and threats discerned in the marketplace, and involving customers and/or competitors in the development of product innovations. Such an increased sensitivity to the environment may also increase the perception of the need to develop flexible structural arrangements. Increased flexibility may allow the organization to respond faster to external pressures and to search for solutions genuinely tailored to the detected problems. Companies with a lower degree of market orientation, on the contrary, may rely predominantly in routinised designs. Taking market orientation as a source of learning, it can be expected that market-oriented firms learn better how to develop and implement more responsive organizing solutions. Ad hoc designs may be one of such solutions, and their superior utilization by companies with higher levels of market orientation, may reflect a learned response to external pressures.

Proaction also proved to have an effect on the utilization of ad hoc designs. This influence may result from the fact that companies with a proactive positioning, aiming to see their products reaching the market before competitors' products, are more alert to the importance of the competitive advantages arising from the kind of flexible and highly responsive structures provided by ad hoc designs. Hence, proaction leads to a deep utilization of ad hoc designs for developing product innovations.

Regression model 6.3

Regression 6.3 considers ad hoc designs as the criterion variable, and technology, market knowledge, product evaluation, proaction, and product assortment as the predictors.

Two antecedents proved to be statistically significant: technology (β = .44, $p<.005$) and market knowledge (β = .38, $p<.005$), with the contribution of these variables producing an R^2 = .47.

Technology and market knowledge proved to be important influences on organizational operations for new product development. More specifically, technological sophistication and refined market knowledge have a positive impact on the adoption of ad hoc designs for product innovation. Technology, in particular, emerged as the best predictor, a finding that may be explained by the fact that project groups, temporary committees, and product innovation committees are more easy to set up and implement when more sophisticated information and communication technologies are available. In the same vein, market knowledge, in the form of more and better information about customers and competitors, may favour the adoption of ad hoc designs, as they appear as effective organizational solutions for handling opportunities and threats that require fast action.

Conclusions of regression models 6.1 to 6.3

Regression models 6.1, 6.2, and 6.3 are those that put ad hoc designs as the dependent variable. For a summary, see Table 5.16.

Table 5.16
A summary of regression results: Models 6.1, 6.2, and 6.3
Regressed variable: Ad hoc designs

	Model 6.1	Model 6.2	Model 6.3
Technology (β)	.56		.44
Knowledge (β)		.44	.38
Evaluation (β)			
Proaction (β)		.33	
Assortment (β)			
R^2	.32	.40	.47
Adj. R^2	.30	.37	.45
F-Value	20.77***	14.67***	18.72***

*p<.05, ** p<.01, ***p<.001.

Note: shaded cells refer to variables not considered for the model; clear cells refer to variables not included in the model.

Results show that: (1) in a simple regression analysis with technology as the regressor, this variable emerged as a significant predictor of the use of ad hoc designs; (2) in a multiple regression analysis with orientation indicators as predictor variables, market knowledge and proaction proved to have a significant impact on the criterion; (3) in the third model, with technology plus orientation

indicators as the independent variables, only two variables emerged, technology and market knowledge. These results indicate that technology and market knowledge are associated with the use of ad hoc designs. This association may result from the fact that the implementation of ad hoc designs is facilitated by the existence of adequate technological means and stimulated by a high degree of orientation towards market knowledge. As demonstrated by regression model 6.2, proaction may also have a significant impact on the adoption of ad hoc designs. This may be interpreted as meaning that the more organizations feel the need to be rapid and agile in responding to detected opportunities, the more they use ad hoc designs. These designs seem to be especially valued when speed of response is an important lever for the organization's strategy, as in the case of proactive organizations, with higher levels of market knowledge. Once these organizations detect opportunities, they seem to use temporary, ad hoc designs, to take advantage of these opportunities, and to transform the detected market needs in new products, to be launched before competitors' products. Taken together, these results illustrate the fact that when companies have the means (under the form of technologies) and the motives (superior market knowledge), to be fast-movers, they will be able and willing to adopt and implement ad hoc designs. Technology, in particular, consistently appeared as the most powerful predictor of the diversity of solutions for managing the choice of organizational designs for product innovation.

5.5.2.7. Permanent designs as criterion variable

Models 7.1, 7.2. and 7.3 have permanent designs as the dependent variable. In the case of model 7.1, technology is the single independent variable. Model 7.2 takes the orientation constructs as the independent variables. Model 7.3 includes all the previous predictors in a single model.

Regression model 7.1

In order to analyse if technology can be thought of as a significant predictor of the use of permanent designs for product innovation, a regression model was built, taking permanent designs as the criterion variable, and technology as the predictor. The results of this simple regression show that technology is not a significant predictor of permanent designs.

Regression model 7.2

Using multiple regression analysis with all the orientation indicators as independent variables, and permanent designs as the dependent variable, an $R^2 = .09$ was found. One variable, market knowledge, emerged as a significant predictor of permanent designs ($\beta = .31$, $p<.05$)

As such, the degree of the firm's market knowledge seems to influence the utilization of permanent organizational designs for product innovation. This relationship may result from the perception that product managers and new product managers may play important roles as boundary spanners. Boundary

spanners (see section 2.2.2.1.1.) may work as valuable sources of information for new product development and, consequently, can be perceived as relevant agents in the collection and internal diffusion of outside information. As a consequence, the more a company intends to have a deep understanding of its market, the more important is the existence of professionals charged with functions of boundary spanning, as those included under the permanent designs label.

Regression model 7.3

In order to analyse if permanent designs for product innovation could be predicted by technology, market knowledge, product evaluation, proaction, and product assortment, regression model 7.3 was built. Of the several hypothesised antecedent variables, market knowledge was the single one to emerge as statistically significant ($\beta = .31$, $p < .05$). The amount of variance explained is 9%.

This result highlights the importance of market knowledge for the adoption of structures and processes that incorporate product managers and new product managers. It is not surprising to find such an association between market knowledge and permanent designs, because a better knowledge of customers, in particular, may stress the advantages of adopting product managers and new product managers. These professionals, staying close to the marketplace, may act as boundary spanners, and thus have an important role in the conversion of information collected in the marketplace into new products. In line with other empirical conclusions obtained in this study, it can be argued that market knowledge may be considered as a key driver for developing more accurate product innovation operations.

Conclusions of regression models 7.1 to 7.3

Regression models 7.1 to 7.3 put permanent designs as the dependent variable. The results are summarised in Table 5.17.

Table 5.17
A summary of regression results: Models 7.1, 7.2, and 7.3
Regressed variable: Permanent designs

	Model 7.1	Model 7.2	Model 7.3
Technology (β)			
Knowledge (β)		.31	.31
Evaluation (β)			
Proaction (β)			
Assortment (β)			
R^2		.09	.09
Adj. R^2		.07	.07
F-Value	n.s.	4.66*	4.48*

*p<.05, ** p<.01, ***p<.001.
n.s. = not significant
Note: shaded cells refer to variables not considered for the model; clear cells refer to variables not included in the model.

The resulting equations show that market knowledge is the single significant predictor of the criterion variable. Such a conclusion is partly consistent with the results of regression equations 6.1, 6.2, and 6.3, as it confirms the role of market knowledge as a significant influence over the adoption of organizational designs for product innovation. It is interesting to note that technology is a powerful determinant of ad hoc designs, but not of permanent designs. This is possibly a consequence of the technologically more demanding requirements needed to put into use the temporary solutions represented by ad hoc designs.

5.5.2.8. Product innovation success as criterion variable

The regression models included under section 5.5.2.8. are those that put product innovation success as the criterion variable. Model 8.1 considers the following predictors: idea generation and screening, business analysis, market testing, ad hoc designs, and permanent designs. Model 8.2 considers the number of new products and product innovation newness as the two predictors. Model 8.3 puts together as regressors all the operations and product innovation indicators as the independent variables.

Regression model 8.1

Taking product innovation success as the criterion and all the product development operations variables (idea generation and screening, business analysis, market testing, ad hoc designs, and permanent designs) as the regressors, a single significant regressor variable emerged: idea generation and screening ($\beta = .32$, $p<.05$). The R^2 for this regression model is of .10.

Hence, the success of a firm's product innovations mostly depends, of among the variables considered, on idea generation and screening. Creating ideas for new products and carefully filtering those ideas, seems to constitute a good strategy for increasing the chances of product innovation success. Considering that the other predictor variables have not entered the equation, it looks possible to conclude that focused creativity seems to be the best way for developing successful new products.

Regression model 8.2

Product innovation success is not influenced by product innovation newness. The number of new products launched by a company, however, seems to exert a powerful influence over new product success ($\beta = .98$, $p<.000$). Using multiple regression an $R^2 = .97$ was obtained.

The extremely high value obtained is not surprising, considering the conceptual overlapping between these two variables. Given the extremely strong positive correlation between the number and success of product innovations, it must be teken into account that this effect may be due to a systematic positive effect of the number of product innovations on the assessment of product innovation success. Therefore, it should be analysed carefully. It should be noted, however,

that the newness indicator was also dependent on the number of new product innovations but it, nevertheless, does not act as a statistically significant predictor of success. With the referred limitations in mind, this regression equation seems to indicate that the best predictor of new product success is the number of new products, not the newness degree of these new products.

Regression model 8.3

Using multiple regression with all product innovation and operations indicators as predictors, and product innovation success as the criterion variable, an $R^2 = .97$ was obtained. Two variables emerged as statistically significant predictors of product innovation success: the number of product innovations ($\beta = .98$, $p<.000$) and ad hoc designs ($\beta = .07$, $p<.05$).

As illustrated by this equation, the number of new products is the best predictor of the degree of product innovations success. The variable ad hoc designs, however, also appeared as a significant predictor of success. The impact of these variables may be due to the following reasons. On the one hand, the evaluation of product innovation success may be dependent on the number of new products launched. This may mean that the companies that launch more products are those that perceive their products as the most successful. Why does this occur ? Two explanations are possible: (1) the number of new products launched may be, itself, an objective measure of success, with companies that launch more products being regarded as the most effective in terms of renewal through new product innovation; (2) companies that make use of ad hoc designs, may be viewed as more innovative, as they implement and make use of innovative solutions to address the management of product innovation.

Conclusions of regression models 8.1 to 8.3

Product innovation success appears to be mostly associated with the number of new products (see Table 5.18).

Table 5. 18
A summary of regression results: Models 8.1, 8.2, and 8.3
Regressed variable: Product innovation success

	Model 8.1	Model 8.2	Model 8.3
Number (β)		.98	.98
Newness (β)			
Adhoc (β)			.07
Permanent (β)			
Idea (β)	.32		
Business (β)			
Testing (β)			
R^2	.10	.97	.97
Adj. R^2	.08	.97	.97
F-Value	5.04*	1345.27***	758**

*p<.05, ** p<.01, ***p<.001.

Note: shaded cells refer to variables not considered for the model; clear cells refer to variables not included in the model.

Other two variables emerged as predictors: (1) idea generation and screening techniques in model 8.1, when only the operations indicators were inputted as the hypothesised predictors; (2) ad hoc designs, in model 8.3, when the organization and operations variables were considered in the model. These results may be indicative of the fact that the success can partly be predicted by how extensively the organization adopts structural solutions that facilitate product innovation, and how actively it engages in the search and selection of ideas for developing new products. Therefore, it can be concluded that a dynamic management of product innovation (including structural design and an active identification of opportunities) is a facilitating condition of new product success.

5.5.2.9. Product innovation programme as criterion variable

Product innovation programme is the dependent variable in models 9.1, 9.2 and 9.3. The independent variables are: the indicators of the operations construct (model 9.1); the indicators of the product innovation outcomes construct (model 9.2); and the indicators of the operations and product innovation outcomes constructs (model 9.3).

Regression model 9.1

Regression model 9.1 with all product innovation operations as predictors, and the product innovation programme success as the criterion, produced an $R^2 = .23$.

Of the predictor variables (idea generation and screening, business analysis, market testing, ad hoc designs, and permanent designs), only the variable ad hoc designs emerged as statistically significant ($\beta = .48$, $p<.005$).

The influence of the degree of utilization of ad hoc designs on the firm's product innovation programme, may be explained by the fact that ad hoc designs signal the organizational willingness and capacity to make use of tailored and fast development processes, which may later be reflected in the perception of the programme's results as a whole. The use of temporary forms of organizing for product development, may increase the efficiency and effectiveness of the product innovation programme, as it can be expected to save time and resources – two highly valued outcomes for organizations competing in turbulent environments – and allow the company to improve its capacity of response to environmental threats and opportunities. Another important facet of ad hoc designs that may help to explain its impact on the company's product innovation programme, lies in the potential advantages of these temporary forms of organization to counterbalance and circumvent more formalised and stable approaches to product innovation. It is natural, then, that these advantages impact the strategic level performance of the company in terms of product innovation, which is reflected in the programme's success.

Regression model 9.2

Using multiple regression with product innovation programme as the dependent variable, and the number of product innovations and product innovation newness as predictors, an $R^2 = .21$ was found.

The number of product innovations launched by the company was found to be a significant predictor of the results of the product innovation programme ($\beta = .46$, $p<.01$).

This result indicates that the success of a company's product innovation programme is best predicted by the number of products launched by the company. The impact of the number of product innovations on the programme's results can be explained by understanding the number of new products as an objective measure of the innovative capabilities of the firm, and therefore its capacity for self-renewal. Companies launching a higher number of product innovations may tend to be perceived as those that have developed a better understanding of the market and of transferring this knowledge about the market into new products. The number of product innovations may thus serve as an indicator of the organizational agility in discerning opportunities and responding to these opportunities by launching products developed to meet them. Building on this result, it can be hypothesised that, more important than launching highly innovative products, may be the capacity to launch new products able to fill the needs detected in the marketplace, which may not necessarily demand product innovations with high newness degrees.

Regression model 9.3

Regression model 9.3 considered product innovation programme as the dependent variable, and all the product innovation outcomes and operations variables as predictors. The model produced an $R^2 = .36$ and two significant predictors: number of new products ($\beta = .37$, $p<.05$) and ad hoc designs ($\beta = .40$, $p<.05$).

These results mean that the number of product innovations and the utilization of ad hoc designs have a significant impact on the organization's product innovation programme. Basically, this regression model confirmed the results obtained in models 9.1 and 9.2, and reinforced the importance of the number of new products. Thus, the evaluation of the company's product innovation programme is based on two different kinds of indicators: the output and the means to achieve that output. In terms of the output, it can be concluded that the higher the volume of product innovations launched by a company, the better the product innovation programme is said to have achieved its goals. As referred, the volume of product innovations may be a means for organizational renewal and organizational agility, and therefore, constitute the most visible and valued goal of the product innovation programme. Not so important, but also significant, is the use of ad hoc designs for product innovation. Ad hoc designs may represent an additional element of self-renewal capacity, translated in the implementation of temporary,

made to measure structures for product innovation. Ad hoc designs, if properly implemented, may facilitate fast answers to unexpected problems and, consequently, be thought of as another dimension of organizational adaptation to turbulent environments. These two variables emerged as the most powerful means for achieving high degrees of product innovation programme success. They are possibly being viewed as complementary explanations of a single phenomenon: the organizational capacity to adjust to its competitive environment, which seems to require the capacity to make internal processes as fluid and tailored to problems as possible.

Conclusions of regression models 9.1 to 9.3

From regression equations 9.1, 9.2, and 9.3, it can be concluded that the variable ad hoc designs is the most powerful predictor of the product innovation programme performance (see Table 5.19).

Table 5. 19
A summary of regression results: Models 9.1, 9.2, and 9.3
Regressed variable: Product innovation programme performance

	Model 9.1	Model 9.2	Model 9.3
Number (β)		.46	.37
Newness (β)			
Adhoc (β)	.48		.40
Permanent (β)			
Idea (β)			
Business (β)			
Testing (β)			
R^2	.23	.21	.36
Adj. R^2	.21	.19	.32
F-Value	9.92**	9.00**	9.12***

*p<.05, ** p<.01, ***p<.001.
Note: shaded cells refer to variables not considered for the model; clear cells refer to variables not included in the model.

The other significant predictor of programme results is the number of new products. This data seems to demonstrate that the evaluation of programme's results depends upon: (1) the emphasis put by the organization on the adoption of flexible designs for product innovation; and (2) the importance of the number of new product introductions as a predictor of the programme's success. Considering the non-existence, in most of the companies surveyed, of objective measures of product innovation programme success (namely financial measures[9]), the number of new products may be the most objective anchor for assessing the programme's success. Thus, product innovation capacity, operationalised in the number of new products, may be perceived as a direct and relatively unbiased measure of how well the product innovation function is doing in the company.

[9] Of the 47 companies, only in one case there were established financial goals for the product innovation programme.

5.5.3. Synthesis of regression results

Table 5.20 displays the variables that emerged as significant predictors of the indicators of endogenous variables in the structural model. This table is basically intended to provide a global overview of the results obtained with the regression analyses discussed before.

The results of regression analyses show that, in the context of the structural model presented and discussed above, some variables have particularly powerful effects as predictors of product innovation operations, outcomes and performance. Table 5.20 presents the variables that were extracted as significant predictors in the regression models. The information provided by this table is basically the same as in Table 5.10, but the different display facilitates the analysis of effects.

Table 5.20
Significant regressors extracted

Regressor	Regressed
Organizational size	Number of product innovations Product innovation newness
Idea generation and screening	Number of product innovations Product innovation newness
Technology	Idea generation and screening Business analysis Market testing Ad hoc designs
Market knowledge	Idea generation and screening Market testing Ad hoc designs Permanent designs
Ad hoc designs	Programme success Product innovation success
Idea generation and screening	Product innovation success
Product evaluation	Business analysis
Number of product innovations	Product innovation success Programme success
Proaction	Ad hoc designs Business analysis (*)

(*) Negative effect

As can be concluded from Table 5.20, technology and market knowledge are the predictors that show significant associations with more criterion variables in the regression models. The importance of technology for product innovation is commonly referred in the literature. The role of market knowledge is now being object of increasing attention in the market orientation literature.

According to a prospective analysis of retail banking (Deloitte Touche Tohmatsu International, 1995), technology will continue to be an important factor in shaping of the sector. The results of the regression analyses clearly illustrate the

impact of technology on product development operations: with the exception of permanent designs, technology serves as a significant predictor of all operations variables. Thus, the importance of technology prowess for product innovation is related with the sophistication of operations that it allows: better technologies facilitate the superior execution of development operations which, in turn, have several positive impacts on product innovation outcomes and performance.

The linkage between market knowledge and innovation is being emphasised by the theory of market orientation. Market knowledge can be considered as a specific outcome of market orientation, whose relevance for product innovation management has been remarked elsewhere (e.g. Thwaites & Edgett, 1991). It is interesting to note that market knowledge is a significant predictor of all but one (business analysis) operations variables. Thus, based on these results, it seems possible to conclude that the more an organization values market knowledge, the more it makes use of sophisticated new product development operations.

The impact of organizational size on the number and success of product innovations, is also an interesting finding: large organizations appear as favourable environments for product innovations to bloom. This may be due to several reasons, including the availability of more and better resources for conducting product innovation and to the routinisation of product innovation operations (Benghozi, 1990). Hence, size is not necessarily harmful for product innovation, neither in terms of number nor of success.

Interestingly, idea generation and screening techniques do also impact the number and success of product innovations. This influence is easy to understand considering that the formal use of techniques for generating new ideas may have a direct influence on the number of new products developed, and that the rigorous screening of these ideas may certainly improve the chances of new product success.

Other significant effects are those of ad hoc designs on product and programme success, which suggests that structural flexibility may be a relevant facilitator of the success of product innovation, namely by allowing the use of designs tailored to problems, and by means of the possible development speed and improvisational capacity allowed by ad hockery. Ad hoc designs may allow 'just-in-time innovation', a precious competitive weapon in high-speed environments.

Proaction emerged as a significant predictor of ad hoc designs and business analysis, in this later case with a negative effect and in association with technology and product evaluation. These impacts are interesting both in theoretical and applied terms, as they illustrate a consistent impact of proaction on organizing for product innovation: on the one hand, proaction positively influences the use of ad hoc designs; on the other hand, it discourages the use of business analysis. These results seem to show the existence of a trade-off between analytical rigour of operations, and the need for speed. Proactive

organizations, aiming to be first-to-market (Miles & Snow, 1978), seem to solve this tension by valuing ad hockery at the cost of extreme analytical rigour.

A last significant association emerged between product evaluation (as predictor) and business analysis (as criterion). This association may be a consequence of the fact that organizations aiming to achieve high product standards (including high levels of product superiority and product differentiation) consider that business analysis may provide relevant information for evaluating new products and deciding which products are worth to launch.

To summarise, Chapter 5 tested and provided empirical support to an organizational model of product innovation performance. The model established several links between organizational level, process and performance level constructs. It confirmed the importance of organization, technology and orientation as determinants of operations and performance. In general terms, the model provided evidence in favour of the need to contextually analyse product innovation. Instead of an isolated process, product innovation is a situated adaptive process that takes place inside organizations. Therefore, to understand product innovation, it is necessary to understand the context where it occurs. The study showed how a set of stable and dynamic factors interact to influence the innovative performance of the firm.

Additionally, several relationships within the context of the structural model were tested in order to obtain a more particularistic perspective about how contexts shape product innovation management and performance. Among other things, these findings illustrated the recurring influence of two variables, technology and market knowledge, in shaping the operations for developing new product innovations. They also highlight the role of organizational size and of techniques for idea generation and screening as determinants of product innovation outcomes (i.e. of the number and newness degree of product innovations), and the number of new products as determinant of both the success of product innovations and of the company's product innovation programme. These findings have several interesting implications both for the study and the management of product innovation in organizations. In Chapter 6, these implications are discussed.

6. Conclusions

6.1. General conclusions

The ability of organizations to improve their adaptiveness by developing new products, is an important topic of interest to marketing and organization disciplines and a central process to market-driven companies. However, and despite a large amount of investigation on the topic of product innovation, the accumulated research efforts on the field have not led, up to now, to a generally accepted perspective about how companies should organize for effectively managing product innovation. The discontent with the knowledge produced may be due to the fact that most research has concentrated on the project level of analysis. Brown and Eisenhardt (1995a) noted that an important item for a research agenda on the topic will be the examination of links between several determinants of product innovation, in order to overcome the limitations of the dominant stream of bivariate analysis.

The present research moved to the multivariate and organizational levels, aiming to understand how do organizational contexts shape the product innovation process and performance of organizations competing in turbulent environments. Thus, in line with Brown and Eisenhardt's (1995a) proposal, it tested the links between some theoretical constructs that are central to a deep understanding of product development.

The work led to some theoretically relevant conclusions, and to a better understanding of how intraorganizational environments contextualise and shape the product innovation process and performance. It tried to provide some empirical evidence relative to two main questions: (1) What factors facilitate (or inhibit) product innovation in organizations ?, and (2) How should the product innovation process best be managed ?

The general conclusions provided by the research will now be analysed.

6.1.1. Impacts of organization

The characteristics of the organization are an important contextual influence on product innovation. The findings of this study confirm the situated nature of product innovation, thus showing that it is not possible to fully understand the practice and performance of product innovation, unless by taking the organizational context that surrounds the development process into account.

The positive and significant impact of organization factors on the number and newness of product innovations, illustrates the importance of macro-structural factors for understanding product innovation. Although the reasons for this effect were not directly addressed in this study, it is possible to hypothesise that large organizations may benefit from the routinisation of processes for developing new products. A less constrained access to the resources needed for conducting the innovation journey may also be an advantage associated with size. The strong correlations between size and financial measures (see 4.5), suggest that large companies may actually constitute munificent intraorganizational environments for product innovation. The empirical evidence of this study also revealed that there is a relevant impact of orientation on product innovation performance.

The results of regression analyses illustrate the significant association between an organization's size and the number and newness of the new products launched. Size emerged as a significant antecedent of product innovation, but the same did not happen with organizational age.

The positive and significant effects of size on both the number and the newness of new products launched by a company is an important finding. This evidence of positive impact of size on product innovation outcomes goes against the frequently held assumption that size (or the correlates of size, like bureaucracy and institutionalisation) works as a barrier for product innovation in organizations, and not as a facilitator (Dougherty & Heller, 1994). The 'badness' of bureaucracy to innovation, however, is more often said than researched, which means that little is known about why and when large bureaucracies become more innovative (Dougherty & Corse, 1995).

This study suggests a positive relationship between organizational factors, and particularly size, and product innovation. It thus supports the specific body of literature that advocates the potential benefits of size to innovation in organizations (Khan & Manopichetwattana, 1989; Pavitt, 1991). According to Pavitt (1991), large innovating firms may take advantage of such characteristics as the development of firm-specific competencies, high levels of differentiation, and high levels of internal collaboration. De Brentani (1986) associated size with higher formalisation of screening decisions, less resource constraints, the simultaneous development of multiple projects, and a higher capacity to absorb risk. All these factors create the conditions necessary for the occurrence, in large organizations, of more product innovations and of product innovations with higher newness degrees, that may demand greater risk and higher investment.

This study's results constitute one more reason for not acritically accepting the 'small is beautiful' slogan. The idea that smallness is good and bigness is bad in terms of product innovativeness, proved to be wrong in this sample. In the financial sector, large and established competitors are in an advantageous position in relation to their smaller and newer counterparts. Instead of rejecting

the advantages of size by implementing downsizing interventions whose consequences can harm product innovation capacity (Dougherty & Bowman, 1995), large competitors should, instead, try to increase organizational agility by adopting sophisticated technologies and a strong market orientation.

6.1.2. Impacts of technology

The marketing literature regularly addresses the management of technology as being of critical importance to throughputs and outputs of product innovation. Cooper (1984), for example, demonstrated empirically that the proactive acquisition of new technologies is a facilitating condition of high performance, especially if the acquired technologies have a high degree of synergy with the resource base of the firm. Barata (1996) empirically demonstrated the impact of information technologies on the development of new products in the Portuguese financial sector. Gatignon and Xuereb (1997) collected evidence which shows that the greater a firm's technological orientation, the greater its product advantage.

Technology proved to be a significant predictor variable of several product development activities. According to regression results, it influences product innovation performance by influencing the quality of the development process. It is then a factor of instrumental value for the creation of superior products, a result that is consistent with previous empirical research (Cooper et al., 1993). It should be remembered, however, that according to PLS results, the individual effect of technology on product innovation performance is only modest. The impacts of technology on the operations variables are visible on four of the five criterion variables, including: idea generation and screening, business analyse, market testing, and ad hoc designs. It should be noted that the only indicator of the operations construct not associated with technology is permanent designs. The lack of association between technology and permanent designs may probably be attributed to the fact that the organizing ways included under the heading 'permanent designs' are probably more traditional and less demanding in terms of technology. The other results provide clear indications that technological sophistication may work as a precondition for successful product development operations. Results of several regression models[1] provide clear indications that the sophistication of structures and operations for new product development may depend on the technological possibilities available to the firm. These results are consistent with the large amount of product innovation studies arguing for the importance of technology, and are interesting in the sense they extend these data, by illustrating the influence of technology antecedents on a very broad range of structural and operational features of the firm's activities related to product innovation.

When product innovation is a key strategic requirement, a firm must be able to advance technology and know-how, exploit these capabilities, and gain market

[1] See models 3.1, 3.3, 4.1, 4.3, 5.1, 5.3, 6.1, and 6.3.

acceptance of new ideas, concepts and production requirements (Lengnick-Hall, 1992).

6.1.3. Impacts of orientation

Ideas for product innovation often stem from a sensitivity to the environment (Khan & Manopichetwatana, 1989), namely by being market-oriented (Cooper, 1984), listening the voice of the customer (Griffin & Hauser, 1993), or being close to lead users (Von Hippel, 1986). Market orientation makes it easier for firms to improve their absorptive capacity, and therefore, their possibilities of learning and responding to customer needs and demands, and of being more aware of threats arising from non-traditional competitors (Slater & Narver, 1995), an advantage that could be especially valuable in industries whose traditional boundaries are blurring, which is the case of the financial services industry.

A distinguishing feature of proactive, market-oriented firms, is their enhanced capacity of information acquisition and processing. Such a differential capacity is at the heart of the high levels of innovation of prospector-like companies (Nicholson et al., 1990). This study, then, confirmed the claim (e.g. Craig & Hart, 1992) that proaction is beneficial to product innovation. Superior product innovation performance may be one of the results of greater access to what Dutton (1993) called 'raw material' for the identification of organizational opportunities, including more data, more angles and more degrees of freedom. The active search for new product ideas is then facilitated by the implementation of proactive strategies, a deep market knowledge, and the development of products with important and desirable features from the customer point of view, whose development requires the utilization of rigorous product evaluation mechanisms.

The results of the present work showed that orientation variables have a positive and significant impact on all operations variables. According to the structural analysis, the total effects of orientation on product innovation performance are, however, modest (see Table 5.24). Thus, external orientation is important because it makes the need for the adoption of rigorous development processes highly visible, and not because it is directly related to new product performance. This finding may provide an explanation for the research results obtained by Moorman (1995). In her study, the author surprisingly concluded that the processes of information acquisition and transmission were not related to product innovation performance. This led Moorman to hypothesise that acquisition and transmission processes were mediated by utilization processes, in a cycle like the following: acquisition → transmission→ utilization → new product performance. This work confirms the mediating effects of utilization processes and suggests that information impacts product innovation performance through the product development operations. Hence, the development operations could be linking information and outcomes. The relationship posited between market orientation and business performance (Jaworski & Kohli, 1993) could then be not a direct

but rather an indirect relationship, mediated by the organizational utilization of market information.

This finding is important because it has two major implications: (1) it confirms the impact of a company's orientation on the operations it puts into practice to develop new product innovations, and (2) it clarifies the relationship between a company's orientation and product innovation performance. Therefore, if orientation on the one hand seems not to significantly impact product innovation performance, on the other hand it influences the adoption of operations that have a relevant influence on product innovation performance. Thus, contrary to what is commonly stated in the literature (Craig & Hart, 1992), there is not a substantial direct effect of strategy on product innovation performance. Strategy, as other orientation elements, appears to be important to the extent it shapes the product innovation operations put forth by a company.

The previous discussion resulted from the structural analysis, but the regression equations allow the presentation of some complementary and more particularistic conclusions regarding the influence of orientation on operations. Firstly, and as referred above, every operations variable was influenced by some orientation predictor. The orientation predictor that showed the highest frequency of significant effects on the criterion variables, was market knowledge. This illustrates the importance of market orientation as a stimulus for a better understanding of the need for more and better use of a set of sophisticated structures and operations to manage product innovation in organizations. More specifically, market knowledge proved to exert a significant influence on idea generation and screening, market testing, ad hoc designs and permanent designs. These findings can be interpreted as supporting the hypothesis that market orientation can be a source of organizational learning as it stimulates the organization to use a diversified and broad range of structures and techniques for addressing the management of product innovation. Significant impacts of product evaluation and proaction have also emerged, with product evaluation being a significant predictor of business analysis, and proaction revealing a significant association with ad hoc designs.

Firms with a prospector-type strategy are more likely to emphasise innovation-oriented learning at both the product and organizational levels. A mismatch of organizational strategy and learning style can be at the basis of product innovation failure (McKee, 1992).

The accurate reflection of market realities is a recurring theme in innovation research (Lengnick-Hall, 1992). The importance of customer-driven innovation has been eloquently emphasised, for example, by quality management gurus like Deming or Feigenbaum. It was also recognised by the growing marketing literature on the topic of market orientation and market-driven management.

The ability to detect and respond to unmet needs, proved to be important in this work. A firm's orientation has a positive impact on product innovation performance because it stimulates the use of more diverse and sophisticated technologies for developing new products. A genuine orientation towards the market, operationalised in such factors like proaction, market knowledge, product assortment, and product evaluation, makes the organization more aware of the need to make use of rigorous processes for developing product innovations. The implications of this finding are interesting because they provide possible explanations for two different phenomena: (1) they constitute a possible explanation of why so many companies do not implement the prescriptions advanced by the product innovation literature; this may happen because organizations do not have neither the goal of being innovative-oriented (they are not market-oriented) nor the technologies that stimulate the adoption of rigorous development operations; (2) it also explains how companies connect the principles of product innovation with day-to-day practices.

The most effective product innovators are those that best articulate the relatively abstract principles for product innovation (communicated by slogans as 'customer orientation', 'the voice of the customer', or 'quality function deployment') with a set of daily routines that turn such principles into concrete activities (Dougherty & Heller, 1994). By converting these potentially empty concepts into daily practices, companies may be turning product innovation from ad hoc to routine, to make use of Benghozi's (1990) terms.

6.1.4. Impacts of operations

Operations for new product development impact the success of individual new products and the success of the overall programme for product innovation. These results show that operations have an impact on product innovation and product innovation performance, influencing both the number/newness as well as the performance of products/programme. These results show that product innovation is significantly associated with how development processes are executed. As referred by Cooper et al. (1993), and confirmed by this model, a market-oriented, customer-focused new product process, is a key ingredient for superior product innovation performance.

Then, and in line with the literature, it seems possible to state that development operations influence product innovation outcomes. The more organizations make use of sophisticated new product development techniques, the more likely they are to have more and newer product innovations, and more successful new products and product innovation programmes.

6.1.5. Impacts of product innovation outcomes

One of the product innovation outcomes indicators, the number of product innovations, showed a significant impact on the success of new products as well

as on the product innovation programme. As referred, the number of new products may be an objective means for assessing how proficient an organization is in managing product innovation. Product innovation newness, in turn, did not show a significant impact on the evaluation of new product success or on programme performance. Several explanations for such a surprising conclusion may be advanced. This may be due to the fact that, given low barriers to imitation, product innovation in the financial sector became, for most competitors, a game of copy and emulation. Therefore, more than looking for highly innovative new products, companies seem to value the capacity of responding to threats and opportunities. In highly competitive landscapes, the number of new products, viewed as a measure of the capacity of avoiding the erosion of the firm's competitive positioning, may be a more valuable competitive weapon than the search for highly innovative new products. Therefore, perception of success is more related to the number than to the newness degree of product innovations.

6.1.6. Summary

According to Yang and Dougherty (1993), successful product innovation encompasses the management of technology and the management of users' problems and needs, with best-performing companies showing a balance between market and technological concerns. This study confirmed Yang and Dougherty's statement and, additionally, established the importance of a set of stable organizational characteristics, including organizational age and size. The structural consequences usually associated with an increase in size and age may have some advantages to companies, especially when combined with strong market orientation and technological prowess.

Overall, the relationships discussed above present product innovation as a learning process, a process that, to be successfully accomplished, requires the interplay between external sources of learning (customers, competitors, technology suppliers), and the internal processes needed to implement a congruent set of strategic and operational level practices, able to allow the internal exploitation of external learning.

6.2. STUDY LIMITATION

After having outlined the major insights provided by the study, its limitations will be discussed. Although the results of this research show pertinent theoretical and empirical consequences, some caution is warranted because of theoretical and methodological limitations.

To start, the findings must be interpreted in light of the general limitations of the study. In terms of theoretical limitations, it must be considered that different indicators could have been picked for operationalizing the constructs. In this

study, selected were only those indicators that, in light of previous research, were the most important. However, other variables could also have been included, namely some often referred key success factors for product innovation, like speed of development, communications strategy, internal marketing synergy, organizational culture, or human resource practices, to name just a few (Drew, 1992a; Cooper et al., 1993).

It should also be noted that this study developed and tested a main effects model. Moreover, the effects may not be directly transferred to other industries, where imitation of product innovations may not be so easy or beneficial. Thus, results do not provide a contingency approach to the management of product innovation. As such, they also do not allow to make any predictions about what strategies work best in different competitive environments. The results, however, pointed out some important antecedents of product innovation performance, and consequently may be useful for the construction of subsequent contingency models.

The fact that the study has been restricted to a single sector, suggests that the analysis conducted here should be repeated in other industries, preferably in industries with different characteristics, industry structures, and key success factors, so that the importance of macro-contextual factors could be assessed. Although the conclusions of this research show general consistency with the literature on product innovation, it is possible that different industrial sectors, or the same sector in different countries, originate different results. Thus, even considering the logical consistency of the propositions advanced and the agreement between the present findings and the findings of prior research, the transfer of these conclusions to other organizational settings should not be taken as a given.

A limitation that comes with the method refers to the impossibility of assessing overall model fit by using PLS. However, the strong path coefficients obtained provide nomological validity to the model and give some confidence on the results.

The cross-sectional nature of the study may also be considered as a limitation. This research provides a 'flash' of the management of product innovation in Portuguese financial services industry in a limited time frame. A longitudinal analysis of product innovation practices and performance would make it possible to assess the stability of the pattern of results found in this study. Additionally, it would also allow an analysis of how the contingent of 'zero-product innovations' organizations would react over time.

A longitudinal study would provide answers to questions like those that follow: is the observed lack of product innovation in some organizations temporary or structural ? Do market-oriented firms consolidate their innovative advantage over

time ? Is there a tendency in the industry to an increase in the number of product innovations ?

Another possible shortcoming of the study, refers to the measures of product innovation performance. As referred, the literature commonly points out the high intercorrelations between measures of product innovation outcomes and performance. Craig and Hart (1992) go one step further to argue that the measurement of new product development success is a non-resolved research problem. As pointed out by these authors, there is no agreement about what measures of product innovation success should be used. The discussion about the appropriateness of hard (financial, objective) or soft (evaluative, subjective) measures, should give place to the exploration of the consistency between these two methodological approaches, as well as to the analysis of how different measures elicit different success criteria. The combination of these approaches would certainly have constituted an interesting research path, but the unavailability of reliable financial data discarded such a possibility for the present study. The attempt to collect data as objective as possible, has not precluded the existence of some kind of halo effect between measures of product innovation outcomes and performance with the first influencing the later.

6.3. THEORETICAL IMPLICATIONS AND DIRECTIONS FOR RESEARCH

The results obtained provide support for two apparently divergent perspectives. On the one hand, they show, in line with the ecological perspective, that organizational size constitutes a competitive advantage (Hannan & Freeman, 1989). On the other hand, they also illustrate the importance of market orientation for the innovative firm: as argued by the organizations as sponges metaphor (Fiol, 1996), organizations need to absorb information from the market, in order to fuel the innovative process.

These conclusions apparently show that the forces for stability (deriving from size) and change (through external orientation) may not only coexist, but also reinforce the possibilities of superior product innovation performance. The combination of a munificent internal environment with a genuine orientation towards the external environment may, then, act as the best means for succeeding in product innovation.

Additionally, the research also provides empirical support to some widely held assumptions about product innovation. It confirmed, for instance, the importance of a firm's orientation: externally oriented firms, with their market focus, may be in an good position to take advantage of close monitoring the business environment and early scanning opportunities for product innovation. It also confirmed the relevance of technological prowess as instrumental for superior product innovation performance.

Moreover, the study allows an explanation of how organization, technology and orientation combine to influence product innovation performance. It shows that organization factors have a substantial impact on the number and newness of product innovations. Size, in particular, proved to be a significant predictor of these outcomes. The study, then, supports the previous empirical evidence that illustrated the existence of a positive effect of size on innovation. The impact of size may be due to the fact that large organizations may have more resources available for conducting product innovations. Considering that large organizations tend to show higher levels of structural inertia, it can also be hypothesised that large organizations with a market orientation, may be profiting from two different factors: effective innovation routines, and an adequate amount of absorptive capacity.

The study additionally shows that technology is important for product innovations not because it has a significant impact on performance, but because it creates the conditions for implementing more sophisticated product development operations. The same seems to be happening with the organization's orientation. Orientation has a modest direct impact on product innovation performance but it is important because of its significant positive effect on operations. Narver and Slater's (1990) and Slater and Narver's (1994) results confirmed that market-oriented firms perform better than other firms. An important question raised by these studies but not addressed by them, refers to the reasons why this occurs. The present study addressed this question and provides some pertinent findings: proactive, market-oriented firms seem to be best product innovation performers because they are more alert to the substantial impact of operations on product innovation performance. Consequently, technological orientation and market orientation, play an important role on product innovation not because of their direct or indirect effects on performance, but because they facilitate the utilization of superior product development processes. Product innovation techniques, in turn, have a substantial effect on product innovation performance. The impact of operations on performance is probably the most consistent finding of the product innovation literature (e.g. Cooper, 1993). It was empirically supported in the present study. Returning to the linkage between orientation and operations, an interesting association uncovered by regression analysis should be discussed. Proaction emerged as a significant predictor of ad hoc designs, with a positive effect, and of business analysis, with a negative influence. This result is illustrative of how an organization's orientation impacts the way it organizes for, and actually manages, product innovation. Proaction favours the adoption of ad hoc designs, and has a negative effect on the adoption of business analysis. This may be a consequence of the importance that these organizations attach to speed and capacity of response to detected market opportunities. Considering that ad hoc designs are tailored designs, adjusted to particular circumstances, they are probably perceived by proactive firms as adequate structural solutions to particular product innovation problems. By contrast, business analysis techniques are probably viewed as too time-consuming tools, therefore increasing the risk of 'missing the boat'. Proactive firms, then, seem to resist the utilization of such

techniques. It should also be noted that ad hoc designs, as can be concluded from the regression analyses, do have a positive effect on product innovation success. Orientation, then, creates the conditions for high product innovation performance by favouring the adoption of the development techniques that influence it. The role of technology is quite the same, as suggested by structural analysis as well as by regression analyses.

Based on the empirical evidence collected here, some possible avenues for future research will probably be worthy of the resources needed to further explore them. For example, an in-depth analysis of how large organizations avoid the bureaucratic effects and adopt an external orientation, is necessary. Such an analysis will require an exploration of how the internal focus associated with institutionalisation, can be substituted by an external focus arising from innovation. The stimulating results obtained by Dougherty and Heller (1994) show that this is certainly a stimulating research path to follow, but more research is needed to uncover how and when routines may favour or harm the development and production of product innovations. The tension between the ecological and the market orientation perspectives, will provide a fertile ground for integrating the complementary processes of innovation and routinisation.

The study of how a drive towards market orientation impacts an organization's structure and culture should also be addressed. Further empirical work on the relationship between cultural types and innovation is necessary, as the present research shows some contradictions: Dickson (1992), in his general theory of competitive rationality, suggests that the clan culture is the best suited to uncertain environments; Deshpandé, Farley and Webster (1993), however, obtained empirical data showing that the clan culture, stressing internal cohesiveness, is outperformed by cultural types that favour competitiveness and entrepreneurship. Deshpandé et al.'s conclusion that best performers are the organizations that have a market culture and are highly customer and innovation-oriented, suggests the need to see how can large firms overcome the typical hierarchical cultures that mostly characterise them. Configurational analysis of structure and process will provide a more detailed perspective of why and how do some large organizations become market-oriented while others do not.

6.4. MANAGERIAL IMPLICATIONS: EVIDENCE OF 'BEST PRACTICE'

The product innovation literature often refers to the fact that many consistent and potentially useful research findings are not being widely employed in organizational settings (e.g. Wind & Mahajan, 1997). One of the reasons why this resistance may occur, could be due to the fact that the complex modeling approaches developed by academics, may not be adjusted to the contexts where product development takes place.

For managers in the financial sector, the empirical results provide some specific orientations, by suggesting possible best practices for managing new product innovation. This research study shows the relations existing between product innovation performance and several organizational antecedent variables. From a managerial perspective, the results can be summarised as follows: (1) some organizational factors commonly thought as associated with the incapacity to innovate may not actually be barriers to product innovation; (2) a firm aiming to achieve superior product innovation performance should have a strong technological orientation; (3) a firm aiming to achieve superior product innovation performance should develop a strong market orientation; (4) the greater the rigor in the development of product innovations, the greater the firm's new product performance; (5) the greater the number and newness of new products launched, the better the firm's product innovation performance.

Below, the applied conclusions derived from the study are discussed in greater detail.

6.4.1. Taking advantage of stability

The study provides some guidelines in relation to what organizations can do when trying to improve their product innovation performance. Firstly, it shows that some factors outside the immediate control of management, like size and age, influence the processes and performance of product innovation. Although they are not easy to manage – size – or are not manageable at all – age –, the study points out the positive influence they exert on product innovation. Thus, large and old organizations may not be in a disadvantageous position in terms of product innovation, as commonly stated by the 'bureaucratic syndrome' literature. According to the study's results, organizational factors, when combined with technological and market orientations, may be at the heart of superior product innovation performance.

The suggestions made by Dougherty and Cohen (1995) for sustaining product innovation in large, mature industries, can be helpful from a managerial perspective, as they show that large and old organizations can not only develop but also sustain product innovation. The integration of functional expertise, the articulation of new products with existing patterns of products and resources, and the alignment between strategic and operational orientations, may constitute adequate solutions for eliminating segmentalism and allowing large and old organizations to be more agile and innovative.

6.4.2. Investing in technological sophistication

Knowledge about customers and competitors is a critical success factor for achieving competitive advantage. To facilitate and disseminate this knowledge, companies need to make customer information instantly available to decision-makers.

Superior market knowledge competence puts several demands in terms of technological sophistication, and particularly in terms of available software. Reliable customer data bases supported by sophisticated computers and telecommunications technology are an important asset for inputting and processing market knowledge data. Considering that market knowledge must be more than a series of occasional insights, technology plays an important role in the management of a firm's orientation: sophisticated technologies make possible the implementation of structured and permanently renewable and accessible customer databases.

In the financial sector, the effects of technology on product innovation performance appear to be only indirect. Nevertheless, they are important as fertilisers of superior product performance, because of their effects on the implementation of rigorous product innovation operations. As noted by Quinn, Baruch and Zien (1996), the recognition by the organization of the potential advantages of software to their development processes, may result in improved innovation quality, shortened product life cycles, lower costs and lower risks.

Product innovation managers should then be aware of the impact of technology on the performance of product innovation and invest in the adoption of technologies (software, in particular) able to help decision-makers in their efforts to uncover promising market needs, and to subsequently transform the best of these opportunities into new products. Sophisticated information technology systems are important because they facilitate the storing and retrieving of market knowledge during the product development process.

6.4.3. Being customer-oriented

To enhance product innovation performance, organizations should adopt a market orientation, coupled with a technological orientation. Market-oriented companies with a high level of technological sophistication are in a favourable position to succeed in the product development challenge. As market orientation may constitute an important source of organizational learning and renewal (Day, 1993; Slater & Narver, 1995), market-oriented firms may be more successful in: (1) igniting the innovation process, by continuously collecting and disseminating information about customers and competitors, and (2) in using this information to develop new products that create superior value to the customer. To put it differently, market-oriented firms may have developed a more accurate understanding that product innovation requires the capacity to absorb inputs so that the generation of valuable outputs becomes possible. This is not only relevant in applied terms, but may also be a potential explanation of why the utilization of product innovation models is so frequently resisted in organizational settings: the techniques themselves are nothing more than tools, whose relevance and pertinence must be recognised and stimulated by the creation of a need for their use. As noted by Fiol (1996: 1013), 'A sponge that

has been left to dry out to the point where it can no longer absorb anything new will not generate outputs no matter how effectively one squeezes it'. This quotation serves to illustrate the adequacy of the organizations as sponges metaphor for analysing product innovation. This work confirms that squeezing harder (i.e. having rigorous and complete product development processes) is a necessary but not a sufficient condition for superior product innovation performance. As discussed, superior product innovation performance results from the combination of filling (Cohen & Levinthal, 1990) and squeezing (Cooper, 1993) competencies: like a sponge, an organization can only be effectively squeezed if is has previously been adequately filled. Market orientation, being a learning orientation, fills the organization with information that, subsequently, can serve to be transformed in new products that provide superior value to the customer.

Managing product innovation, then, basically consists in understanding the importance of creating absorptive capacity (through a market orientation) and development capacity (by mastering the product innovation process).

An excessive emphasis on the development process may distort the understanding of how organizations actually achieve competitive advantage through product innovation: limiting the focus to the 'squeezing' process may deviate attention from the importance of the 'filling' activities. This research confirmed that 'filling' and 'squeezing' are intertwined processes, whose execution determines a firm's level of product innovation performance. Phrased differently: this study confirmed marketing and innovation as the two basic (and complementary) functions of the market-driven company (e.g. Webster, 1994). Thus, it is not enough to be market-oriented, unless constant innovation delivers better value to customers in the marketplace, which happens through effective innovation processes.

It should be pointed out that there seems to be a gap between the best practices provided by the results of this study and the actual practices of many companies that participated in the study. According to the descriptive analysis of the financial sector, most companies appear to be more competitor-oriented than customer-oriented. This evidence may not be specific of the Portuguese financial sector. In fact, the same result has been obtained by Edgett (1992) with a sample of British building societies. As reported by the author, many new product introductions by those companies were of the 'me too' type. Other authors, have also pointed out the deficiencies of product development operations in the financial sector: Thwaites and Edgett (1991) found that British building societies have not developed the level of innovation considered satisfactory for characterising truly innovative organizations in turbulent environments; Bowers (1986) concluded that the current product innovation processes employed by a sample of American banks should be improved; Schuster's (1987) analysis, focusing the practices of European banks, diagnosed several product innovation management deficiencies, including 'forgotten products' and a wrong

conceptualisation of the product innovation function, which is frequently viewed as a public relations instead of a strategic issue.

It is true that such a competitor orientation may have several benefits, like providing some relevant insights for benchmarking purposes, but also important shortcomings, like increasing the probability of imitative innovation. The potentially resulting 'me too' product introductions may have an especially rapid proliferation when companies react to the competition instead of the market. Although 'me too' products may play several roles that make them important for organizations (keep product innovation active and facilitate routinisation, neutralise competitor moves, activate the organizational capacity of renewal, provide opportunities for learning-by-doing), they also entail some risks, namely those that refer to the loss of a consistent approach to the market due to 'follow-the-competitor' moves. The above characteristics of the financial sector may be due to a combination of two situations that are typical of the financial services environment world-wide: (1) many diverse areas of the sector have been stable for many years, and (2) only recently, and by force of technological development, deregulation and market globalisation, have these areas been subjected to an accelerated rate of change. So, the present situation, characterised by a strong 'vigilance' of competitors' moves and many non-innovative companies, may be indicative of a transitional state of a sector whose borders are now being redefined, by force of new entrants and changing core technologies.

Although competitive orientation may be thought of as part of a firm's market orientation, some authors make a distinction between customer orientation and competitor orientation (Gatignon & Xuereb, 1997). Following the definition of Narver and Slater (1990), the customer oriented firm is one that knows its target buyers good enough to continuously create superior value to them. The competitor-oriented firm, in turn, is one that knows its competitors good enough to continuously respond to their actions. According to Gatignon and Xuereb, a competitor orientation can be both proactive and reactive. Even considering that a response to a competitor move may be a stimulus for a future proactive behaviour, the risks of reactor type action to which competitor-oriented firms are exposed, seems to be greater than that of customer-oriented firms. This risk may be especially strong if there is a tradition of imitative innovation in an industrial sector with low barriers to copying competitors' products. This, as discussed above, is the case of the financial sector.

6.4.4. Implementing rigorous product innovation operations

The study confirmed the positive impact of a systematic product development process on the achievement of superior product innovation performance. In practical terms, this means that expertise in the product development game is a necessary condition for achieving superior product performance.

This is in line with the practicalities advanced by the well-known prescriptive research tradition in the field of product innovation. It is important to note, however, that a systematic process is not a rigid process. The negative association between proaction and business analysis illustrates the need to manage in time, and to accelerate development speed. Understanding of the importance of time may constitute a critical factor for successful organizational renewal because, as pointed out by Day (1993), winning firms know that they have to beat their competitors in, among other things, speed-to-market.

The acceleration of product development doesn't go without costs. Then, more than staying rigidly attached to some kind of product innovation plan, companies should develop the knowledge and be proficient both about how and when to use plans, and how and when to skip phases.

6.4.5. Committing to continuous improvement through product innovation

The retention of customers is an important competitive requirement. To be retained, customers must be satisfied. Customer satisfaction over time seems to require a constant flow of product innovations (Webster, 1994). Inevitably, most of these innovations will be improvements of existing products. This may be especially true in the financial services sector, where it is difficult to achieve much product differentiation (Edgett, 1994).

The impact of the number of new products on the innovative performance of the firm, shows that continuous product improvements may constitute an important competitive requirement. By launching new products, companies tune their competencies with customer needs and, to the extent that product innovations provide valuable solutions to those needs, they pave the way for relationship marketing (Webster, 1994). Product innovations adapted to specific customer needs and further updated to new customer requirements, may constitute a key ingredient for longtime relationships with customers.

A wide range product assortment with continuous product innovation may be an important building block of competitive advantage, because the trend toward mass customisation tends to reward those companies able to respond to the level of increasing variety demanded by new business environments. Managers should then prepare their companies to a permanent state of flux in terms of new product introductions.

Such a state of flux, propelled by a commitment to continuous innovation, has several advantages. It acts as a powerful stimulus for organizational learning and, therefore, can be expected to reinforce the need for product innovation. Additionally, it may be helpful for companies to create innovation routines and to make explicit the need for an active and consistent management of product portfolios. This last point seems to be of particular importance in the financial

sector, given that, as referred by Schuster (1987), financial organizations frequently have a high number of 'forgotten products', products that, although formally in existence, are not the object of any kind of diffusion effort, which means that, in practice, there is no reason for retaining them in the company's product portfolio.

6.4.6. Summary

This section summarises the four major sets of management implications arising from the study:

(1) Stable and difficult-to-manage organizational factors usually associated with lack of innovation, like size and age, are not necessarily harmful to product innovation. Size is not itself a barrier to product innovation. Therefore, some caution is warranted before implementing downsizing techniques. These techniques, being potentially appropriate when the goal is to increase efficiency, can harm the organization's innovative capacity. The disruptions of downsizing on the firm's product innovativeness capacity have been empirically documented by Dougherty and Bowman (1995). Before downsizing their companies, managers should then carefully analyse the extent to which organizational strategy requires high levels of product innovation capacity. In terms of product innovation capacity, it seems to be wise to avoid the bureaucratic syndrome by implementing genuine technological and market orientations. Such orientations take advantage of the benefits associated with bigness, including slack and professionals, and do not eliminate the amounts of redundancy needed for innovation to occur (Nonaka, 1990), that are frequently eliminated during downsizing intervention programmes.

Organizational age also has some implications. The advantages of higher age have to do with the fact that inputs from customers and suppliers transpire through well-established relationships. Familiarity is an advantage of older and experienced companies. As referred by Krackhardt (1996), recently founded organizations suffer from a systems knowledge disadvantage, which may penalize the product innovation capacity of younger firms. To overcome this liability, recently founded companies may, for example, hire professionals from competing firms with established liaisons in the marketplace. These professionals may accelerate the recognition of the company by customers and suppliers.

(2) Advanced technology has an important instrumental value for achieving a superior product innovation performance. The adoption and utilization of up-to-date technologies, constitutes a pre-requisite for high product innovation performance. This means that technological prowess is a pre-condition for a sophisticated product development process. Thus, a blending of technological and market orientation is a key ingredient for superior performance.

(3) Orientation is a factor of major importance for organizations aiming to excel in product innovation. Although not having a direct impact on performance, an external orientation is important because it paves the way for the implementation of sophisticated innovation processes. Externally and innovation-oriented organizations (i.e. proactive organizations that put emphasis on product evaluation, rigorous market knowledge, and a broad product assortment) are best positioned to win the product development game (Takeuchi & Nonaka, 1986).

(4) A well-bred, market-driven development process should be implemented. Customer input may be thought of as a fundamental driver of product innovation, but its benefits will greatly depend on the organizational capacity to transform inputs into products that deliver superior value to the customer. Considering the key role of sophisticated, market-driven development processes as a determinant of product innovation in organizations, managers should carefully implement systematic product development operations.

The evidence collected in this research suggests that most financial organizations have not yet learned the cruciality of market orientation as a stimulus for successful product innovation. Particularly in the financial sector, because of the intangible nature of products, close links with customers are not only important for igniting and developing the product innovation process, but also for learning how to effectively communicate the product characteristics to its potential buyers. Given the intangible nature of financial products and the ease of their imitation, a clear understanding of how products should be communicated may be an important management tool.

These conclusions, in turn, allow the derivation of an important meta-conclusion: success in product innovation stems from the combination of a series of factors that should be consistently managed at the same time. It is not, thus, the result of the application of any kind of prescription or 'easy-to-use' recipe.

Considering the impact of market orientation and innovation on the overall performance of organizations (Deshpandé et al., 1993), this research provided some helpful insights for practising managers in the financial industry, as well as, conceivably, for other sectors undergoing rapid environmental change. Although restricted to Portuguese financial organizations, the conclusions arising from this research do presumably have a wider application.

In fact, financial institutions all over the world are experiencing a period of turbulence. Therefore, the best practices found for the Portuguese financial industry, may also have some pertinence to other industrial and national contexts. Organizations and industry sectors that are encouraging product innovation, in particular, may have some relevant insights to take from the reported findings.

6.5. FINAL COMMENTS

The study presented here explored several aspects in the development of product innovations in the financial services industry. First, a comprehensive conceptual model of product innovation performance was developed. Second, measurement issues were addressed and dealt with. Third, the model was tested and found to explain substantial variance in product innovation performance. Fourth, some guidelines for the management of product innovation were provided.

In theoretical terms, the study contributed to a more comprehensive understanding of the key determinants of product innovation performance, and the interrelationships between these determinants. These interrelationships showed that researchers need to shift the focus of product innovation from an internal process to a balanced internal and external one.

The applications for the management of product innovation can be divided in two major blocks: (1) a descriptive analysis of the state of the art of product innovation management for the financial sector in Portugal was provided, and (2) some best practices for the management of product innovation were outlined, based on the results of the structural and regression analyses.

In summary, the study suggests that many financial organizations need to improve the approaches used for developing new products. By having a strong market orientation, combined with technological prowess, organizations are more apt to implement good development operations, were been found to increase the firm's success rate in terms of product innovation performance. Firms with high knowledge-based competencies and superior technological competencies, will be in a favourable position to cope with the increasing turbulence that is expected to characterise future financial markets.

In more general terms, the study also shows that previous investigation has been successful in accumulating a relevant body of research on the topic. This research has provided empirical evidence that supports the relevance of the theory of market orientation for understanding the competitive behaviour or organizations. Additionally, it is expected, it provides a conceptually richer context for the study of the product innovation process. The contextualisation of product innovation is important not only because it adds theoretical richness to the study of this issue, but also because it helps to provide one possible explanation for how does a market orientation impact a firm's product innovation performance.

As in every research, this study didn't prove that the tested model is empirically true: it only failed to disprove it. Subsequent research on the organizational context of product innovation will hopefully help to refine knowledge about how contexts and processes interact to create the product innovating company.

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Appendices

Appendix 1

The research instrument (original Portuguese version)[1]

[1] Considering that there are only minor differences between the banking and insurance versions of the research instrument, Appendix 1 displays only one of these versions (banking).

Questionnaire-Form A

QUESTIONÁRIO

Contacto: Dr. Miguel Pina e Cunha- 418 85 82

O questionário que aqui se inicia tem objectivos exclusivamente académicos e determinados pela realização de uma tese de doutoramento na Universidade de Tilburg, Holanda.

Todas as informações prestadas estão sujeitas ao mais rigoroso sigilo. Garante-se a total confidencialidade das respostas dos inquiridos, bem como a realização de um tratamento estatístico que respeite o anonimato das pessoas e das organizações participantes.

As respostas devem ser assinaladas nos espaços sombreados. Em caso de dúvida, não hesite em pedir esclarecimento. Muito obrigado pela sua colaboração.

1. Caracterização da organização

1.1. Características da organização

Número de empregados	
Número de agências	
Número de empregados por agência	
Idade média dos empregados	
Média de habilitações escolares dos empregados	
Grupo económico de pertença	
Dispersão geográfica das agências (nº de localidades)	
Ano da fundação	
Estatuto: privado, público, ex-público (ano da privatização)	
Número de níveis hierárquicos	
Departamentalização (direcções)	

1.2. Indicadores (1994)

Activo	
Resultados líquidos após impostos	
Depósitos captados (e quota)	
Crédito concedido (e quota)	
Capitais próprios	
Proveitos operacionais por nº de empregados	
Custos com pessoal, por nº de empregados	

2. Inovação de produtos

2.1. Qual o valor e a percentagem dos resultados, depois de deduzidas as taxas e comissões, decorrentes de novos produtos (isto é, produtos lançados ao longo dos três anos anteriores ao ano em análise) ?

Em 1994		%
Em 1993		%
Em 1992		%
Em 1991		%
Em 1990		%

2.2. Qual o número de novos produtos lançados nos últimos anos ?

1994	
1993	
1992	
1991	
1990	

2.3. Qual o rácio (em percentagem) de novos produtos/total de produtos ?

1994	%
1993	%
1992	%
1991	%
1990	%

3. Análise da Inovação de Produtos

Passamos agora à análise do número de produtos lançados em cada uma das gamas a seguir consideradas: produtos financeiros de passivo, produtos financeiros de activo, serviços bancários gerais e serviços bancários especializados. Para responder a esta parte do questionário deverá proceder como se segue:

(a) Número de inovações: indicar o número de novos produtos/serviços lançados pela sua organização no ano transacto (1994), na gama correspondente

(b) Timing das inovações: neste caso, deverá assinalar, dessas inovações, qual a percentagem daquelas que caíram nos vários 'timings' de lançamento: (1) produtos lançados antes dos da concorrência; (2) produtos lançados ao mesmo tempo que os equivalentes da concorrência; (3) produtos lançados depois dos da concorrência.

(c) Grau de novidade: neste caso, deverá assinalar quais os produtos: (1) novos para o mundo; (2) melhorias de produtos já existentes; (3) adições às actuais linhas de produtos; (4) reduções de custo; (5) reposicionamentos.

(d) Resultados: neste caso, deverá indicar quais os produtos cujos resultados ficaram: (1) muito abaixo das expectativas; (2) abaixo das expectativas; (3) de acordo com as expectativas; (4) acima das expectativas; (5) muito acima das expectativas.

Gama	Número Inovações	Timing			Novidade					Resultados				
		1	2	3	1	2	3	4	5	1	2	3	4	5
Produtos financeiros de passivo														
Produtos financeiros de activo														
Serviços bancários gerais														
Serviços bancários especializados														

Questionnaire-Form B

QUESTIONÁRIO

Contacto: Dr. Miguel Pina e Cunha- 418 85 82

O questionário que aqui se inicia tem objectivos exclusivamente académicos e determinados pela realização de uma tese de doutoramento na Universidade de Tilburg, Holanda.

Todas as informações prestadas estão sujeitas ao mais rigoroso sigilo. Garante-se a total confidencialidade das respostas dos inquiridos, bem como a realização de um tratamento estatístico que respeite o anonimato das pessoas e das organizações participantes.

As respostas devem ser assinaladas nos espaços sombreados. Em caso de dúvida, não hesite em pedir esclarecimentos. Muito obrigado pela sua colaboração.

1. Tipo estratégico

Nesta secção, vamos-lhe pedir que caracterize o posicionamento estratégico da sua organização. Para isso, pedimos-lhe que leia o texto que se segue e que, depois, escolha a opção que mais se aproxima do seu banco. Leia, por favor, o texto de forma neutra, evitando considerar algum tipo de organização como superior aos outros. Na verdade, o trabalho científico de Miles e Snow demonstrou não haver uma estratégia melhor que as outras.

1.1. Quatro Tipos de Bancos

Um banco de TIPO A mantém um «nicho» de mercado seguro, oferecendo aos seus clientes um conjunto relativamente estável de serviços e produtos. Regra geral, uma organização de TIPO A não pretende ser a primeira (ou das primeiras) a lançar os novos produtos/serviços bancários. Este tipo de organizações tende a prestar pouca atenção às mudanças que não tenham impacto directo nas suas áreas de operação tradicionais, concentrando-se, pelo contrário, na tarefa de fazer o melhor trabalho possível no seu domínio de competição.

Um banco de TIPO B altera regularmente os seus serviços e produtos. Procura arduamente ser o primeiro banco do mercado a oferecer os novos produtos e/ou serviços. Um banco de TIPO B está sempre à procura de novas oportunidades, de modo a corresponder mais eficazmente às necessidades do mercado.

Um banco de TIPO C mantém uma linha estável de serviços e produtos mas, ao mesmo tempo, está atento a oportunidades em termos de novos serviços/produtos que lhe pareçam promissoras. Ao contrário da organização de tipo B, a de TIPO C prefere oferecer poucos novos produtos/serviços, apostando fortemente em fornecer aqueles produtos/serviços que lhe parecem muito bem concebidos. Um banco de TIPO C frequentemente aguarda pelos resultados obtidos noutros bancos, só depois decidindo se oferece, ou não, os novos produtos/serviços em questão.

Um banco de TIPO D é mais difícil de caracterizar. Não procura oferecer um núcleo estável de produtos como o tipo A, nem é tão agressivo na busca de novas oportunidades como os tipos B e C. Um banco de TIPO D aguarda pela obtenção de evidência considerável, que lhe permita concluir que o novo produto/serviço é realmente necessário.

Tendo em conta as descrições anteriores, indique em qual dos quatro tipos estratégicos acima referidos, melhor se encaixa, actualmente, a sua organização:

Tipo ☐

1.2. Análise da concorrência

Usando ainda a mesma descrição, classifique por favor, os seguintes bancos em termos da estratégia usada por cada um deles. É natural que não conheça de forma rigorosa ou aprofundada cada uma destas instituições. Em todo o caso, pedimos-lhe que caracterize todos os bancos de acordo com a sua percepção de cada um deles.

Banco Bilbao Vizcaya (Portugal)		Banco Borges & Irmão	
Banco Chemical (Portugal)		Banco Comercial de Macau	
Banco Comercial dos Açores		Banco Comercial Português	
Banco de Fomento e Exterior		Banco de Investimento Imobiliário	
Banco Espírito Santo		Banco Essi	
Banco Finantia		Banco Fonsecas & Burnay	
Banco Internacional de Crédito		Banco Mello	
Banco Nacional de Investimento		Banco Nacional Ultramarino	
Banco Pinto & Sotto Mayor		Banco Português do Atlântico	
Banco Totta & Açores		Banco Internacional do Funchal	
Banco de Comércio e Indústria		Banco Nacional de Crédito Imobiliário	
Banco Português de Investimento		Banco Português de Negócios	
Banco Santander de Negócios Portugal		Caixa Geral de Depósitos	
CISF-Banco de Investimento		Citibank Portugal	
Companhia Geral de Crédito Predial Português		Credit Lyonnais Portugal	
Deutsche Bank de Investimento		Finibanco	
Montepio Geral		União de Bancos Portugueses	

1.3. Processo organizacional

Depois de termos abordado a questão da estratégia, passamos a analisar alguns dos processos internos da organização. No grupo de doze questões que se seguem, pedimos-lhe que utilize a sua experiência para nos ajudar a compreender o funcionamento da organização. Para assinalar a sua resposta, basta colocar uma cruz no espaço correspondente à opção que se lhe afigura como a mais ajustada. Um exemplo:

0. Imagine a questão 'Com que frequência vai ao cinema ?'. Caso nunca vá ao cinema, deverá responder como se segue:

nunca	raramente	algumas vezes	frequentemente	muito frequentemente
1	2	3	4	5

Depois de apresentado o exemplo, passamos então ao grupo de doze questões.

1. O nosso banco tem sido o primeiro a oferecer os novos produtos/serviços:

nunca	raramente	algumas vezes	frequentemente	muito frequentemente
1	2	3	4	5

2. O nosso banco tem oferecido um leque de produtos/serviços:

muito estreito	estreito	médio	extenso	muito extenso
1	2	3	4	5

3. Em relação à banca em geral, o número de novos produtos e serviços oferecidos pelo nosso banco tem sido:

muito inferior à média	inferior à média	médio	superior à média	muito superior à média
1	2	3	4	5

4. O nosso banco, antes de decidir se havia de oferecer um novo produto/serviço, aguardou pelos resultados da experiência dos outros:

nunca	raramente	algumas vezes	frequentemente	muito frequentemente
1	2	3	4	5

5. O nosso banco, indo ao encontro de todas as necessidades, procurou gastar o mínimo possível de recursos (humanos, económicos, tecnológicos):

Discordo completamente	Discordo	Não concordo nem discordo	Concordo	Concordo em absoluto
1	2	3	4	5

6. No nosso banco, o planeamento de formação profissional pode ser descrito como:

Informal | 1 | 2 | 3 | 4 | 5 | Formal

7. O nosso banco, quando precisa de profissionais competentes numa determinada área:

Forma os empregados | 1 | 2 | 3 | 4 | 5 | Contrata novos empregados

8. No nosso banco, a avaliação de desempenho das chefias baseia-se em:

Comportamentos | 1 | 2 | 3 | 4 | 5 | Objectivos/resultados

9. No nosso banco, o salário das chefias, depende mais de:

A lógica interna da empresa | 1 | 2 | 3 | 4 | 5 | A competitividade externa

10. No nosso banco, a organização pode ser descrita como:

Centralizada | 1 | 2 | 3 | 4 | 5 | Descentralizada

11. No nosso banco, e em comparação com os outros bancos, a actualização tecnológica dos equipamentos não especificamente bancários (hardware informático, tecnologias de comunicação), é:

Inferior | 1 | 2 | 3 | 4 | 5 | Superior

12. No nosso banco, e em comparação com os outros bancos, a actualização dos equipamentos bancários (software para o cálculo de juros, simulação de operações, etc.), é:

Inferior | 1 | 2 | 3 | 4 | 5 | Superior

2. Orientação para o cliente

As afirmações que se seguem tentam ajudar a caracterizar algumas das práticas da relacionamento entre a organização e o seu ambiente de negócio. Responda assinalando a opção que melhor descreve a sua organização, tendo em conta que:

1= Discordo fortemente e 5= Concordo fortemente

1. Nesta organização a qualidade de serviço é medida com regularidade	1	2	3	4	5
2. O desenvolvimento de produtos e serviços é baseado na informação recolhida junto dos clientes e do mercado	1	2	3	4	5
3. Conhecemos bem os nossos concorrentes	1	2	3	4	5
4. Temos uma percepção apurada da opinião que os clientes têm acerca dos nossos produtos e serviços	1	2	3	4	5
5. Somos mais direccionados para os clientes do que os nossos concorrentes	1	2	3	4	5
6. Competimos principalmente com base na diferenciação de produtos e serviços	1	2	3	4	5
7. O interesse dos consumidores surge sempre em primeiro lugar, antes mesmo do interesse dos accionistas	1	2	3	4	5
8. Os nossos produtos / serviços são os melhores do mercado	1	2	3	4	5
9. Acreditamos que este negócio existe principalmente para servir os consumidores	1	2	3	4	5

Questionnaire- Form C

QUESTIONÁRIO

Contacto: Dr. Miguel Pina e Cunha- 418 85 82

O questionário que aqui se inicia tem objectivos exclusivamente académicos e determinados pela realização de uma tese de doutoramento na Universidade de Tilburg, Holanda.

Todas as informações prestadas estão sujeitas ao mais rigoroso sigilo. Garante-se a total confidencialidade das respostas dos inquiridos, bem como a realização de um tratamento estatístico que respeite o anonimato das pessoas e das organizações participantes.

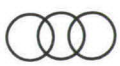
As respostas devem ser assinaladas nos espaços sombreados. Em caso de dúvida, não hesite em pedir esclarecimento. Muito obrigado pela sua colaboração.

1. Área Técnica (Departamento de Desenvolvimento de Novos Produtos)

Existe nesta organização um departamento específico e formalmente responsável pelo desenvolvimento de novos produtos?

Sim	Não
Designação	Qual o orgão que mais se lhe assemelha ?
Quantas pessoas o constituem ?	Quantas pessoas o constituem ?
Em que Direcção se localiza ?	Em que Direcção se localiza ?
Em que ano foi constituído ?	Em que ano foi constituído ?
Quais as funções que lhe estão formalmente atribuídas ?	Quais as funções que lhe estão formalmente atribuídas ?

Apresentam-se a seguir três possíveis abordagens ao desenvolvimento de novos produtos. Depois de ter analisado cada uma delas, queira assinalar (no espaço sombreado) qual o tipo predominante na sua organização.

	Tipo A	O processo decorre de forma ordenada e sequencial. O papel e o 'timing' de cada equipa interveniente estão claramente definidos e não se confundem com os das restantes equipas. Não há sobreposição de tarefas: cada equipa desenvolve a sua própria actividade, após o que o projecto transita para a equipa seguinte.
	Tipo B	Também aqui existe uma sequência pré-estruturada, mas é estimulado o contacto entre equipas nas fases de transição do projecto de uma equipa para a seguinte. Este procedimento faz com que, por vezes, uma fase possa ser iniciada sem que a anterior haja sido concluída.
	Tipo C	Neste caso, em vez de uma sequência linear, visa-se a sobreposição do trabalho das diversas equipas. A equipa interveniente vai-se alargando à medida que o projecto se desenvolve, porque as várias equipas vão acompanhando o desenrolar do processo mesmo depois de a sua intervenção directa já ter ocorrido.

2. Marketing

Existe nesta organização um departamento específico e formalmente responsável pelo marketing ?

Sim	Não
Em caso afirmativo, qual a sua designação ?	Em caso negativo, qual o orgão que mais se lhe assemelha ?
Quantas pessoas o constituem ?	Quantas pessoas o constituem ?
Em que Direcção se localiza ?	Em que Direcção se localiza ?
Em que ano foi constituído ?	Em que ano foi constituído ?
Quais as suas funções formais ?	Quais as suas funções formais ?

3. Articulação marketing /área técnica

As questões que se seguem dizem respeito à articulação organizacional das actividades de marketing e da área técnica (desenvolvimento de novos produtos) no caso concreto das actividades de desenvolvimento de novos produtos. Responda por favor, assinalando uma cruz no espaço correspondente àquilo que acontece na sua organização. Caso estes departamentos não existam formalmente, responda em relação àqueles que, na prática, executam aquelas funções. Note que, neste grupo, deverá colocar uma cruz nos quadrados correspondentes aos vários departamentos que intervêem no processo. O que significa que, para cada fase, poderá responder em mais do que uma casa. Note que, uma vez mais, apenas deverá responder nas casas a sombreado. Os rectângulos a branco servem apenas para localizar os processos no interior de cada fase.

Departamentos / Fases	Marketing	A.Técnica	Comercial	Outros (*)
Planeamento				
definição de orçamentos				
estabelecimento de prioridades				
Inovação				
geração de ideias				
desenvolvimento do conceito				
Comercialização				
comercialização				
Pós-comercialização				
avaliação				
redefinição do produto				

4. Desenvolvimento de Novos Produtos/Serviços

As questões que se seguem destinam-se a analisar as práticas de desenvolvimento de novos produtos e serviços nesta organização. Assinale uma cruz na opção que melhor caracteriza a sua organização.

4.1.Pré-desenvolvimento

4.1.1. Técnicas de geração de ideias para novos produtos

Nesta secção pretende-se analisar a frequência de utilização de algumas técnicas de geração de ideias para novos produtos. Para responder, basta assinalar a opção que melhor descreve aquilo que se passa na sua organização.

1=Nunca e 5=Sempre

Estudos prospectivos	1	2	3	4	5
Pesquisa de mercado	1	2	3	4	5
'Brainstorming'	1	2	3	4	5
'Gap analysis'	1	2	3	4	5
Dissecação de produtos competitivos	1	2	3	4	5
'Benchmarking'	1	2	3	4	5
Outro (*)	1	2	3	4	5

(*) especifique

4.1.2. Filtragem das ideias

Nesta secção, pretende-se averiguar a frequência de utilização das diversas técnicas de filtragem das ideias para o desenvolvimento de novos produtos. Responda assinalando o quadrado correspondente à opção que melhor caracteriza a sua organização.

1= Nunca e 5= Sempre

Política de produto	1	2	3	4	5
'Check lists'	1	2	3	4	5
Filtragem por profissionais	1	2	3	4	5
Outro (*)	1	2	3	4	5

(*) especifique

4.1.3. Arranjos organizacionais para o desenvolvimento de novos produtos

Neste grupo, pretende-se saber, das possíveis técnicas de gestão da inovação de produtos, aquelas a que a sua organização recorre. Para responder, assinale na escala à frente de cada questão qual a frequência com que cada uma das técnicas é utilizada. Uma vez mais, a escala varia entre:

1= Nunca e 5=Sempre

1. grupos de projecto	1	2	3	4	5
2. comités de inovação de produto	1	2	3	4	5
3. comités temporários de inovação de produto	1	2	3	4	5
4. departamento de desenvolvimento de produtos	1	2	3	4	5
5. gestor de novos produtos	1	2	3	4	5
7. gestores de produto	1	2	3	4	5
8. outro (*)	1	2	3	4	5

(*) Especifique

4.2. Desenvolvimento

4.2.1. Análise de negócio

Nesta secção pretende-se analisar o modo como é feita a análise de negócio relativamente aos novos produtos. Responda assinalando o quadrado correspondente à opção que melhor caracteriza a sua organização.

1= Nunca e 5= Sempre

Estimativa de vendas	1	2	3	4	5
Estimativa das vendas iniciais	1	2	3	4	5
Estimativa das vendas por substituição	1	2	3	4	5
Estimativa das vendas repetidas	1	2	3	4	5
Estimativa de custos e lucros	1	2	3	4	5
Outro (*)	1	2	3	4	5

(*) Especifique

4.2.2. Teste de mercado

Nesta secção, pretende-se analisar qual a frequência de utilização das diversas técnicas de teste de mercado. Assinale, para cada item, o quadrado correspondente à opção que melhor caracteriza a sua organização.

1= Nunca e 5= Sempre

Mini-teste de mercado	1	2	3	4	5
Teste completo de mercado	1	2	3	4	5
Teste laboratorial	1	2	3	4	5
Outro (*)	1	2	3	4	5

(*) Especifique

4.3. Resultados

4.3.1. Abordagem qualitativa

As questões que se seguem visam analisar, de forma qualitativa, o sucesso do programa de desenvolvimento de novos produtos.

1. Em que medida o programa de desenvolvimento de novos produtos alcançou, ao longo dos últimos cinco anos, os seus objectivos financeiros ?

Contribuição mínima	1	2	3	4	5	Enorme contribuição

2. Qual a importância do programa para a geração de vendas e lucros para a organização

Pouco importante	1	2	3	4	5	Muito importante

3. Em que medida os lucros dos novos produtos excedem os custos do seu programa de desenvolvimento

Em pouco	1	2	3	4	5	Em muito

4. Quais os resultados do programa em relação aos resultados dos programas equivalentes da concorrência

Inferiores	1	2	3	4	5	Superiores

5. Em termos globais, qual o sucesso do programa

Pouco	1	2	3	4	5	Muito

4.3.2. Abordagem quantitativa

As questões que se seguem são questões de tipo quantitativo.

Orçamento do departamento de inovação de produtos	
Tempo médio necessário para o desenvolvimento de novos produtos (dias)	

Qual a percentagem das vendas da organização decorrente de novos produtos introduzidos no mercado nos últimos 5 anos	
Qual a percentagem de produtos que tiveram sucesso	
Qual a percentagem de produtos que falharam	
Qual a percentagem de produtos eliminados antes do lançamento no mercado	

Appendix 2

A guide (in English) to the research instrument[2]

[2] For the purpose of correspondence, sections in the original Portuguese version are presented between brackets in Appendix 2. A-1, for example, refers to Form A, section 1 in the original version.

Descriptives. Descriptive sections include all those parts of the instrument designed to provide data not to test the model, but to allow an overview of relevant organizational characteristics. Descriptive sections include the organizational characteristics and financial indicators (A-1, i.e. Form A, section 1, in the original Portuguese version), the structural organizing of product innovation (C-1) and marketing departments (C-2).

Organizational size. Number of employees of the organization (A-1).

Organizational age. Count of the number of years passed since the foundation of the organization (A-1).

Organizational strategy: Self-assessment. Four strategic types were presented, according to the Miles-Snow typology (B-1.1). After reading these descriptions, subjects were asked to chose the one that best fits their company. The descriptions were as follows:

TYPE A organizations keep a safe market niche,by offering to its clients a relatively stable set of products and services. In general, a TYPE A organization does not aim to be the first (or one of the firsts) to launch new products or services. These organizations are nor especially interested in those changes that do not have a direct impact in its traditional areas of operation, choosing to concentrate in doing its best in its competitive domain.

TYPE B organizations change their products and services on a regular basis. Is tries hard to be the first offering the new products or services. A TYPE B organization is always looking for new opportunities, in order to better satisfy market needs.

TYPE C organizations maintain a stable portfolio of products and services but, at the same time, it tries to identify new opportunities in terms of potentially promising new products/services. Contrarily to the TYPE B organization, TYPE C companies prefer to offer few new products/services, selecting only those opportunities that appear potentially very successful. A TYPE C organization frequently waits for results obtained by competitors, and then decides to offer (or not) such products or services.

TYPE D organizations are most difficult to characterize. They do try to offer a stable core of products, like type A, nor are agressive as types B and C while looking for new opportunities. A TYPE D organization waits to reach for considerable evidence until it may conclude that the product/services is really necessary to satisfy customers demands.

Organizational strategy: External assessment. Considering the descriptions presented in the self-assessment section, respondents were asked to classify competitors according to the strategic type that best describes them (B-1.2).

Organizational strategy: Consistency test. A 5-point Likert scale with ten items queried respondents on the strategic positioning of the firm (B-1.3): frequency of launching new products before competitors (never-always); product portfolio scope (narrow-large); number of new product offerings before competitors' (far below average-far above average); degree of competitor analysis prior to new product launch (never-always); degree of efficiency (low-high); staffing practices (training of employees-selection of new employees); performance appraisal focus (behaviors-goals); determinants of compensation (corporate policy-external competitiveness); decision-making (centralized-decentralized); hardware technological sophistication (low-high); software technological sophistication (low-high).

Customer orientation. A 5-point Likert scale was used. Items on the scale described several customer-oriented practices, and subjects were asked to indicate the extent to which the sentences described their organizations (from 1 = completely disagree to 5 = completely agree, see B-2): measuring service quality on a regular basis; develop new products/services based on feedback from customers; deep understanding of competitors; accurate understanding of customers' perception of product/service quality; degree of customer-orientation of the firm compared with competitors; degree of product /service differentiation; putting customers's interests before shareholders'; having the best products in the market; believing that the market mainly exists to serve customers.

Idea generation techniques. A 5-point Likert scale with six items queried respondents on the extension of use of idea generation techniques, including (from 1 = never use to 5 = always use; C-4.1.1): prospective studies; market research; brainstorming; gap analysis; dissecting competitive products; benchmarking.

New products screening. A five-point Likert scale with three items measured the extent to which the following practices were used for the purpose of new product screening (from 1 = never use to 5 = always use; C-4.1.2): product policy; check lists; screening by experts.

Organizational designs for new product development. A five-point Likert scale with seven items queried respondents on organizational designing for new product development. Subjects were asked to describe the extension of use of the following structural designs (with 1 = never use, and 5 = always use; C-4.1.3): project groups; product innovation committees; temporary committees for new product development; product innovation department; new product managers; product managers.

Business analysis. A 5-point Likert scale with five items asked respondents about the utilization of the following methods of business analysis (from 1 = never use

to 5 = always use; C-4.2.1): estimating sales; estimating first-time sales; estimating replacement sales; estimating repeat sales; estimating costs and profits.

Market testing. Three 5-point Likert scales assessed the frequency of utilization of several approaches to market testing (from 1 = never use to 5 = always use; see C-4.2.2), including: mini-market tests; full-market testing; laboratory testing.

Number of new products. Total number of new products developed by the company in the referred period (A-3).

New product newness. A table was presented (A-3), asking subjects to indicate the number of new products falling in each of five different newness categories: new to the world; product improvements; additions to product lines; cost reductions; repositionings.

New products' success. A table was presented (A-3), asking subjects to indicate the number of new products falling in each of five different success categories: products that performed much lower than expected; lower than expected; as expected; better than expected; much better than expected.

Product innovation program success. A 5-point Likert scale measured the extent to which the new product development program reached its goals (C-4.3.1). Items asked respondents about: the extent to which the financial goals have been reached in the last five years; the importance of the program to the company's profits; the degree to which the programs' revenues were superior to its costs; the degree of program success compared to equivalent programs by competitors; the programs' overall success.

Appendix 3

Descriptive statistics

Table A-3.1
Strategy self-classifications

Type	Count	Percentage
Defenders	8	17.21
Prospectors	12	25.53
Analysers	27	57.45
Reactors	0	0

Table A3.2
Strategy external assessments

Type	Count	Percentage
Defenders	18	38.30
Prospectors	6	12.77
Analysers	17	36.17
Reactors	2	4.26

Note: missing cases refer to those cases where more than one modal value has been obtained

Table A3.3
Descriptive statistics for Likert-scaled strategy questions

Strategic type[1]	N	Mean	Minimum	Maximum	SD
Defenders	8	28,79	19,00	36,00	6,17
Prospectors	12	34,10	27,00	40,50	4,06
Analysers	27	30,88	22,60	38,50	3,88

[1] As self-assessed

Table A3.4
Results of the market knowledge scale

Item description	Means	SD
Regular measures of product quality	3.07	1.15
Product development based on market information	3.21	1.02
Knowledge of competitors	3.70	1.01
Reliable market information about company's products and services	3.48	.77

Table A3.5
Results of product evaluation scale

Item description	Means	SD
Superior customer orientation compared with competitors	3.42	.98
Competition based on product differentiation	3.51	.95
Product superiority in relation to competitors	3.43	.95

Table A3.6
Results of idea generation and screening scale

Item	Means	SD
Forecasting	2.65	.97
Brainstorming	3.36	1.25
Gap analysis	2.59	1.05
Dissection of competitive products	3.69	.81
Idea screening in function of product policy	3.29	1.08
Check lists	2.45	1.06

Table A3.7
Results of business analysis scale

Item	Means	SD
Sales estimates	3.83	.93
Initial sales	3.10	1.27
Sales by substitution	2.62	1.25
Estimate of repeated sells	2.62	1.22

Table A3.8
Results of market testing scale

Item	Means	SD
Mini market test	2.31	1.27
Full market test	1.58	.74

Table A3.9
Results of ad hoc designs scale

Item	Means	SD
Project teams	3.24	1.17
Product innovation committees	2.23	1.05
Temporary product innovation committees	2.49	1.08

Table A3.10
Results of permanent designs scale

Item	Means	SD
New product managers	2.36	1.22
Product managers	3.01	1.43

Table A3.11
Results of programme's results scale

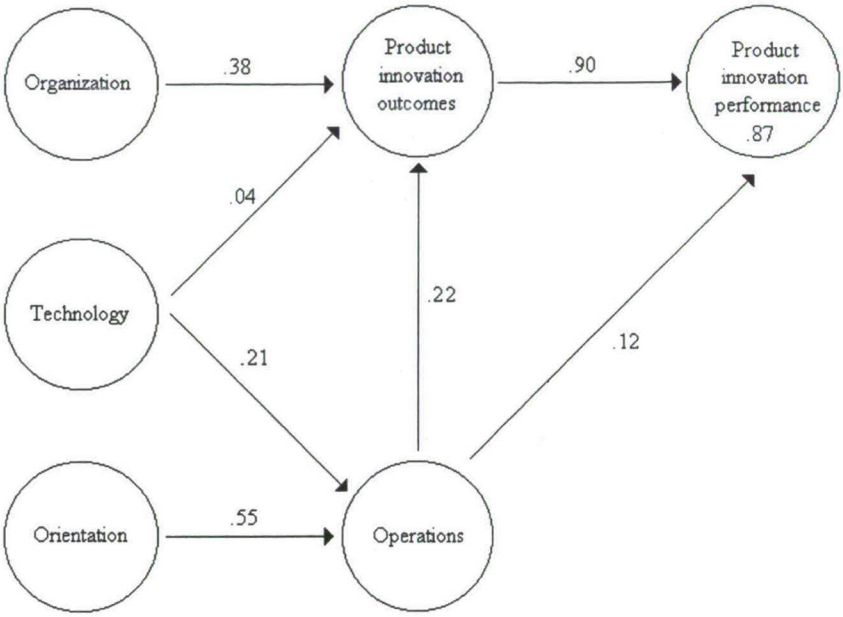
Item description	Means	SD
Degree of achievement of financial goals	3.51	1.07
Impact on sales and profits	3.79	1.03
Success compared with competitors' programmes	3.26	.92
Overall programme success	3.63	.90

Appendix 4

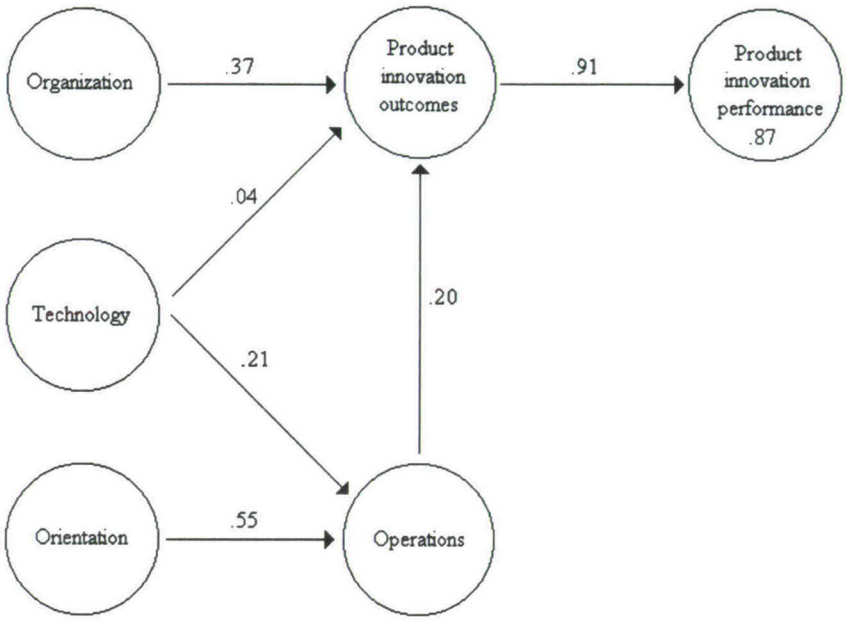
Competing PLS models

The models presented below represent some possible, theoretically meaningful variations, to the model presented and analysed in Chapter 5. These variations consider the possible influence of technology on product innovation outcomes, while keeping all other causal links unchanged (competing model #1), and without the linkage between operations and product innovation outcomes (competing model #2). Competing model #3 tests the possibility and a direct influence of technology on product innovation outcomes, and not on product innovation operations. These models basically aimed to analyse how technological factors impacted product innovation outcomes. It can be concluded that the direct impact of technology on product innovattion outcomes is negligible. The study does not deny the importance of technological factors to product innovation success, a well established research finding (e.g. Nystrom, 1985). It shows, however, that the impact of technology over product innovation outcomes my be mediated by product innovation operations: technological prowess leads to more refined operations, that, in turn, lead to superior product innovation outcomes.

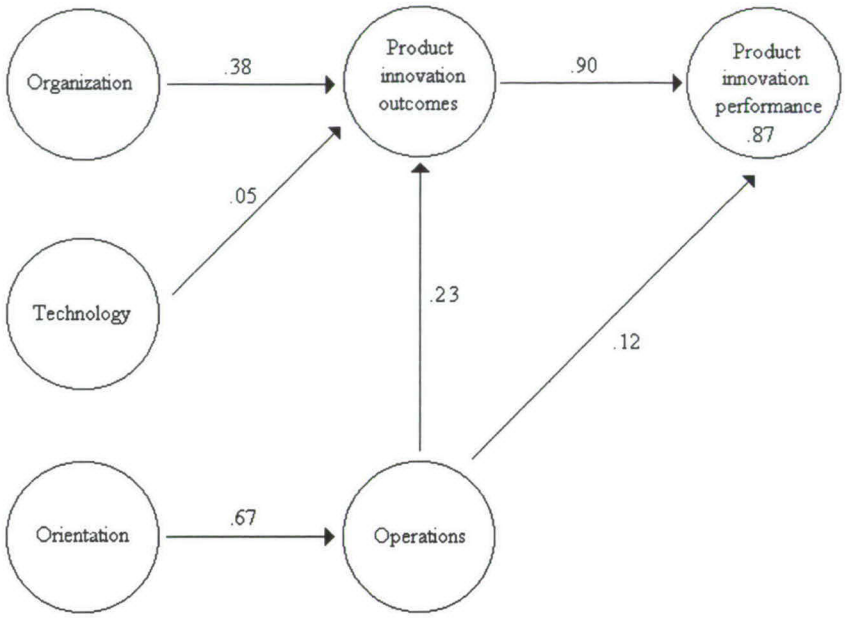
Competing model #1



Competing model #2



Competing model #3



Summary

The intense competition propelled by a rapid technological development presents major challenges to a firms' ability to keep pace with environmental change. Product innovation may be required to maintain or consolidate a firm's position in the marketplace. It can thus be thought of as an essential ingredient for organizational adaptation and renewal.

Despite the voluminous recent literature on product innovation, more knowledge about the articulation between product development operations and organizational characteristics is necessary.

This study analysed the impact of three exogenous constructs on the practice and performance of product innovation in organizations. These constructs are:

- Organization, referring to the stable and inert characteristics of organizations, including the firm's size and age;
- Technology, or the degree of technological prowess;
- Orientation, dealing with how the organization approaches the marketplace, including strategic-level characteristics, like proaction and market orientation.

To analyse the impact of the above constructs on product innovation performance, a conceptual model was built and operationalised. The model basically investigated the effects of the exogenous constructs on the following endogenous constructs:

- Operations, referring to the organizational degree of sophistication in the management of the product innovation process, including both the structural solutions implemented and the development processes in use;
- Product innovation outcomes, dealing with the results of the product innovation process, including the number of product innovations and their newness degree;
- Product innovation performance, or to what extent the product innovation function accomplished its goals, including the success of new products and of the overall product innovation programme.

The linkages between the exogenous and endogenous constructs were established through the following set of propositions:

- Organizational factors positively and indirectly affect product innovation performance through product innovation outcomes (P_1);
- Greater technological sophistication positively and indirectly affects product innovation outcomes and performance through product development operations (P_2);

- Superior market orientation positively and indirectly affects product innovation outcomes and performance through product development operations (P_3);
- Superior product innovation operations leads to more and newer product innovations (P_4);
- Superior product innovation operations leads to a better product innovation performance (P_5);
- Superior product innovation outcomes leads to better product innovation performance (P_6).

The model was empirically tested in a sample of Portuguese financial organizations (N = 47). The model was specified and its parameters estimated following the partial least squares (PLS) approach to structural equation modeling. The data confirmed the statistical significance of all six paths, and allowed to conclude that the model has nomological validity. Thus, all six propositions presented above were confirmed.

In theoretical terms, the confirmation of the model's adequacy shows that product innovation is influenced and shaped by the contextual intraorganizational environment where it takes place. Thus a deeper understanding of how product innovation performance can be improved, requires a deep understanding of how it is shaped by organizational factors, as those considered in this model. It is interesting to note that the data confirms the adequacy of the organizations-as-sponges metaphor and provides relevant knowledge for converting the powerful but potentially too abstract concept of market orientation into daily organizational practices, hence making its utilization by organizations more effective.

The study also presents some evidence for the derivation of best practices in the management of product innovation. The practices leading to high performance were characterised by a technologically aggressive, innovative, proactive, and market- oriented stance. They include:

- an aggressive technological orientation with a proactive acquisition of new technologies;
- a market-oriented approach, featuring a proactive search for product innovation opportunities;
- the development of products with a relatively diverse and sophisticated new product process.

Additionally, it is important to note that large and old organizations appear to be in a favourable position in terms of total product innovation capacity. This means that, instead of taking for granted the disadvantages of size and age, marketing researchers and practising managers should create the conditions to overcome the so-called bureaucratic syndrome, and capitalise on the benefits arising from these stable characteristics.

This study identified some strategies that differentiate high performers, and provides a useful benchmark for managerial decisions. A combination of technological prowess, strong external orientation with a proactive stance, and the search for differential advantage product innovation processes, appears to be the key to high performance product innovation programmes.

Although the data of this study was exclusively collected in the Portuguese financial services industry, the best practices identified are conceivably applicable to other contexts and industries as well. The presumed generalizability of the findings is based on the fact that several research investigations in other industries produced results that are basically consistent with those of the present study.

In a competitive business environment marked by the shortening of product life cycles, the increasing speed of technological development, and the blurring of industry borders, managers increasingly recognise the importance of product innovation to a company's growth and survival. The need to treat product innovation as a key strategic process becomes more visible. This research uncovered some key links in the management of product innovation, and provided several guidelines for the design of innovation-oriented firms. The ultimate conclusion is that the creation of a stream of new product winners is the result of a customer-oriented, rigorously executed product innovation process.

Samenvatting

De intensieve competitie die voorgestuwd wordt door de snelle technologische ontwikkeling biedt grote uitdagingen aan het vermogen van een onderneming om tred te houden met omgevingsveranderingen. Productvernieuwing is nodig om de positie van een onderneming in de markt te behouden of the consolideren. Zij kan derhalve gezien worden als een essentieel onderdeel van bedrijfsaanpassing en -vernieuwing.

Ondanks de veelheid aan recente literatuur over productvernieuwing is het noodzakelijk meer kennis te verwerven over de afstemming tussen product-vernieuwingsprocessen en de kenmerken van een onderneming.

Dit onderzoek bestudeerde de invloed van drie exogene begrippen op de praktisering en de prestatie van productvernieuwing binnen organisaties. Deze begrippen waren:

- Organisatie, hetgeen verwijst naar de stabiele en onveranderlijke karakteristieken van organisaties, met inbegrip van de omvang en de leeftijd van een bedrijf;
- Technologie, oftewel de graad van technologische vooruitgang;
- Orientatie, hetgeen verband houdt met de wijze waarop het bedrijf de markt benadert, met inbegrip van strategische kenmerken, zoals proactiviteit en marktoriëntatie.

Om de invloed van bovengenoemde begrippen op de productvernieuwingsprestatie te bestuderen werden een conceptueel model geformuleerd en geoperationaliseerd. In de grond onderzocht het model de invloeden van de exogene begrippen op de nu volgende endogene begrippen:

- Operaties, hetgeen verwijst naar de graad van geavanceerdheid in het management van het productvernieuwingsproces, met inbegrip van de structurele oplossingen die worden geïmplementeerd en de ontwikkelings-processen die worden gehanteerd;
- Productvernieuwingsuitkomsten, hetgeen verband houdt met de resultaten van het productvernieuwingsproces, met inbegrip van het aantal product-verniewingen en hun vernieuwingsgraad;
- Productvernieuwingsprestatie, oftewel, de mate waarin de product-vernieuwing haar doel bereikte, met inbegrip van het succes van nieuwe producten en van de algehele productverniewingscampagne.

De verbindingen binnen de exogene en endogene begrippen werden gelegd door de nu volgende stellingen:

- Ondernemingsfactoren hebben een positieve en indirekte invloed op product-vernieuwingsprestatie door mediëring van de productvernieuwings-uitkomsten (P_1);
- Grote technologische vooruitgang heeft een positieve en indirekte invloed op productvernieuwingsuitkomsten en -prestatie door mediëring van de product-vernieuwingsoperaties (P_2);
- Een hogere graad van marktorientatie heeft een positieve en indirekte invloed op productvernieuwingsuitkomsten en -prestatie door mediëring van de product-vernieuwingsoperaties (P_3);
- Een hogere graad van productverniewingsoperaties leidt meer en meer vernieuwende productvernieuwingen (P_4);
- Een hogere graad van productverniewingsoperaties leidt tot een hogere product-vernieuwingsprestatie (P_5);
- Een hogere graad van productvernieuwingsuitkomsten leidt tot een hogere product-vernieuwingsprestatie (P_6).

Het model werd empirisch getoetst met een steekproef van Portugese financiele instellingen (N = 47). Het model werd gespecificeerd en de parameters werden geschat op basis van de Partial Least Squares (PLS) benadering van Structural Equations Modeling (SEM). De gegevens bevestigden de statistische significantie van alle zes paden en lieten toe te concluderen dat het model over nomologische validiteit beschikt. Zodoende werden alle zes bovengenoemde stellingen bevestigd.

In theoretisch opzicht toont de bevestiging van de toereikendheid van het model dat productvernieuwing beïnvloed en gevormd wordt door de contextuele intra-organisationele omgeving waar zij plaatsvindt. Derhalve behoeft een beter begrip van de wijze waarop productvernieuwingsprestatie verbeterd kan worden een beter begrip van de wijze waarop zij gevormd wordt door organisationele factoren, zoals de factoren opgenomen in dit model. Het is interessant op te merken dat de gegevens de toepasselijkheid van de onderneming-als-spons metafoor bevestigen en relevante kennis aandragen voor de vertaling van het krachtige maar mogelijk al te abstracte begrip van marktoriëntatie in dagelijkse ondernemingspraktijk, en daardoor het gebruik van een dergelijke oriëntatie effectiever maken.

Het onderzoek toont ook enige empirische aanknopingspunten voor hoe men het best product-vernieuwing kan beoefenen binnen het management. De praktijken die tot de beste prestaties leidden werden gekarakteriseerd door een technologisch agressieve, innovatieve, proactieve en marktgeoriënteerde houding. Dit houdt in:

- een agressieve technologische oriëntatie met een proactieve verwerving van nieuwe technologieën;
- een marktgerichte benadering, gekenmerkt door een proactieve opsporing van product-vernieuwingsmogelijkheden;
- de ontwikkeling van producten met een relatief divers en geavanceerd proces voor nieuwe producten.

Verder is het belangrijk op te merken dat grote en gevestigde ondernemingen in een bevoordeelde positie schijnen te verkeren voor wat betreft de mogelijkheid tot totale productvernieuwing. Dit betekent dat, in plaats van de nadelen van omvang en leeftijd voor lief te nemen, marktonderzoekers en praktiserende managers de condities dienen te scheppen om het zogenoemde bureaucratische syndroom te boven te komen en te kapitaliseren op de voordelen van dergelijke stabiele karakteristieken.

Dit onderzoek identificeerde enige strategieën die beter presterenden onderscheiden en verleent een bruikbaar vergelijkspunt voor managementbeslissingen. Een combinatie van technologische vooruitgang, een sterke externe oriëntatie with een proactieve houding, en het zoeken naar productvernieuwingsprocessen met een differentieel voordeel schijnen de sleutel te zijn voor produkvernieuwings-campagnes met hoge prestaties.

Alhoewel de gegevens van dit onderzoek uitsluitend verzameld werden in portugese financiële instellingen, de beste praktijken die geïdentificeerd werden zijn mogelijk ook toepasbaar op andere omgevingen en bedrijfstakken. De veronderstelde veralgemeniseerbaarheid van de resultaten is gebaseerd op het feit dat andere onderzoeken in andere bedrijfstakken op vergelijkbare resultaten uitkwamen.

In een competitieve omgeving gekenmerkt door een verkorting van de levensduur van producten, een toenemende snelheid van technologische ontwikkeling, en de verdwijnende grenzen tussen bedrijfstakken, zien managers steeds meer het belang in van product-vernieuwing voor de groei en het voortbestaan van het bedrijf. De noodzaak om product-vernieuwing als een centraal strategisch proces te behandelen wordt zichtbaarder. Dit onderzoek toonde enkele verbindingen aan in het management van productvernieuwing en droeg verscheidene richtlijnen aan voor het ontwerp van vernieuwingsgeoriënteerde bedrijven. De uiteindelijke conclusie is dat het ontwerp van een stroom van nieuwe productwinnaars het resultaat is van een klantgericht, grondig uitgevoerd productvernieuwingsproces.

In a competitive business environment marked by the shortening of product life cycles, the increasing speed of technological development, and the blurring of industry borders, managers increasingly recognise the importance of product innovation to a company's survival and growth.

This study analysed the impact of three exogenous constructs (organization, technology, orientation) on the practice and performance of product innovation in organizations.
Some key success factors in the management of product innovation were uncovered, and guidelines for designing innovation-oriented firms provided.

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